INSTRUCTION MANUAL

INTERFERENCE ANALYZER

MK III Repair

MODEL EMC-25

10KHz - 1000MHz

ELECTRO-METRICS
A DIVISION OF PENRIL CORP.

ELECTRO-METRICS AUTOMATED SYSTEMS (20 Hz to 18.0 GHz) with optional computer coordination

FSS-250 AUTOMATED EMC SYSTEM: 20 Hz to 1 GHz

Model **FSS-250** Automated EMC System is widely used for MIL-STD-461/2 and other testing of EMC emissions. Single-sheet automatic X-Y plots of data simplify and condense testing.

- Antennas and other pick-up devices automatically switched as scan progresses.
- Entire 20 Hz - 1000 MHz range plotted in minutes; rate adjustable.
- Spectrum analysis mode of operation offers CRT quick look at pre-selected data on each octave band before plotting.
- Dual-pen **FSS-250D** Option allows plotting peak and average levels simultaneously.

Other Options Include:

PSA-125 Programmable Attenuator, for band-by-band attenuation control.

PSS-125 Programmable Scan Speed Control, for band-by-band control of scan rate.

PGC-25 Programmable Gain Control, for band-by-band control of EMC-25 gain.

PIF-25 Programmable Bandwidth control, for band-by-band selection of IF bandwidth.

DIU-125 Digital Interface Unit, for extension of FSS-250 Automation to computer control.

FIU-125 Frequency Indicating Unit, for digital readout of EMC-25 frequency. (require "L" option on EMC-25).

The Model **FSS-250** integrates into a single, highly-effective system:

EMC-10 Interference Analyzer, 20 Hz - 50 kHz,

EMC-25 Interference Analyzer, 10 kHz - 1000 MHz,

ESC-125A Programmer,

EXY-125B X-Y Plotter,

SPD-125 Spectrum Display Module,

CCP-125V Control and Calibration Panel,

SPK-100 Speaker Module,

SU-125 Antenna Switching Unit, and

Dual-bay, slant-front console with all interconnecting cables.

Model **FSS-250D** substitutes dual-pen X-Y plotter, Model EXY-250C. See EMC-25 listings for other options available.

Building-Block approach allows for modular build-up to complete system.

COMPUTER-COORDINATED EMC SYSTEMS 20 Hz to 18.0 GHz

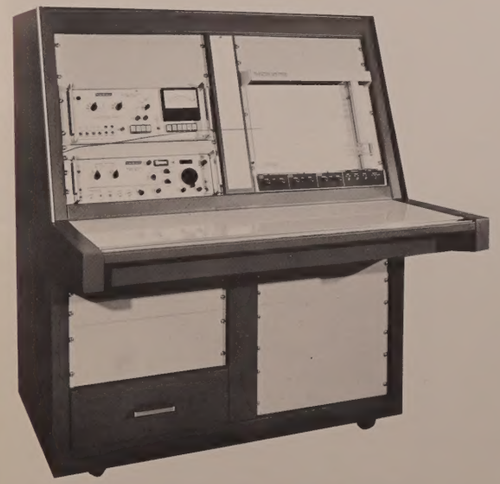
Since 1970, Electro-Metrics has developed and delivered a number of computer-coordinated EMC systems. Capability in this area recently was augmented by initiation of closer collaboration with Penril's Data Communications Division which specializes in digital technology.

Available technology and hardware in the digital computer area continue to expand so rapidly that the risk of obsolescence to any standard digital-computer system design is significant. The approach at Electro-Metrics, therefore, is one of continually updating our library of modular computer-system design elements. This enables us to offer each customer, at lowest possible cost, a system which is up-to-date and custom-matched to his unique requirements.

With Building Blocks now available for computer-coordinated systems for measurements to almost any EMC specification, anywhere in the range 20 Hz to 18.0 GHz, our ability to meet your particular needs is unexcelled.

Your inquiries in this regard are welcomed and will be accorded a prompt response.

FSS-500 MICROWAVE EMC SYSTEM: 1.0 to 18.0 GHz



The **FSS-500** offers automated EMC measurements at microwave frequencies (1.0 to 12.4 GHz, extendable to 18.0 GHz). Single-sheet X-Y plots of calibrated data shorten test cycles and save man-hours.

Options Include:

Model **SPD-50** for CRT Spectrum-Analyzer-type data display.

Model **FSS-500D** provides dual-pen X-Y plotter in lieu of single-pen, for concurrent plotting of peak and average levels.

Model **RGA-50** Ridged Guide Antenna covers 1.0 to 12.4 GHz and is built per ECOM drawings.

The **FSS-500** consists of three modules integrated into an effective system and available with or without cabinet:

1. Microwave Receiver, Model **EMC-50**, with tuned-YIG preselector coverage to 12.4 GHz, optionally, to 18.0 GHz.
2. Microwave Control Module, Model **MCM-50**, including special metering, calibration, and programming functions.
3. X-Y Plotter, Model **EXY-125B** providing,single-sheet, hard-copy, plots of data, in 1-, 4-, and 6-band formats.

- Front end remotable for location at antenna, to optimize sensitivity.
- Four RF Bands cover 1.0 to 12.4 GHz; 5th optional band adds 12.4 to 18.0 GHz.
- Single-sheet X-Y plots of band-segments, single bands or band combinations in 1-, 4-, and 6-band format.
- Plotting rate variable 30 sec. to 30 min. per band.
- IF bandwidths (-6 dB) of 100 kHz, 1 MHz, and 20 MHz.
- Low-noise design for sensitivities of +2 dBuv narrowband and +2 DBuv/MHz broad-band, both tangential.
- RF attentuation steps of 0, 20, 40, 60 dB plus separate IF attenuation steps of 0, 10, 20 dB.
- Narrowband dynamic range of 70 dB without attenuator switching.
- 60 dB-range front-panel meter.
- Internal impulse generator for self-calibration.

ELECTRO-METRICS

INSTRUMENTATION FOR TESTING EMC EMISSIONS

20 Hz to 18.0 GHz

MIL-STD-461/2 • SAE • FCC • ANSI • CISPR

MANUAL, AUTOMATED, OR COMPUTER OPERATION

Check the table below for the models that match your needs.

CAPABILITY	FREQUENCY RANGE		
	20 Hz - 50 KHz	10 KHz - 1000 MHz	1.0 - 12.4/18.0 GHz
Basic Interference Measurements for MIL-Std-461/2, SAE, FCC, etc.	EMC-10 EMC-10E	EMC-25R EMC-25RX(20 - 1000 MHz)	EMC-50/MCM-50
CISPR/ANSI Testing	For ≥ 10 KHz →	CMM-25/EMC-25	EMC-50/MCM-50
X-Y Plotting of EMC Data	EMC-10E/EXY-125 or EMC-10/ESC-10A/ EXY-125B	EMC-25 (any model) with ESC-125A and/or EXY-125B or EXY-250C with DJB-252	EMC-50/MCM-50 with EXY-125B or EXY-250C
CRT Spectrum Display of EMC Data	Info available on non-standard setup	EMC-25/SPD-125 = CSR-200	EMC-50/MCM-50 with SPD-50
Antennas and other Pickup Devices	PEF-10 ALP-10 PCL-10 PCL-10/PCA-10 ELS-10	RVR-25 MFA-25 RVA-25 MFB-25 ALR-25 MFC-25 PCL-25 EFP-25 BDA-25 BIA-25 LCA-25	RGA-50
Automated EMC Data Collection	FSS-250 Automated EMC System 20 Hz - 1000 MHz		FSS-500 Microwave EMC System
Computer-Coordinated Systems	"Custom" System Designs using Standard Available Building Blocks		

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ELECTRO-METRICS EMC-25 INTERFERENCE ANALYZER

EMC-25 (10 kHz to 1000 MHz)

Designed for EMC emission testing per MIL-STD-461/2, FCC, SAE and other specifications.

EMC-25R is standard full-range model covering 10 kHz - 1000 MHz. Partial coverage models also available.

EMC-25RN includes N option of 3rd IF bandwidth for extra CW sensitivity.

EMC-25RX includes "N" option but tunes only 20 - 1000 MHz.

"L" suffix adds optional L.O. output.

CMM-25 adapts any of above models to CISPR/ANSI testing.

- Tunes 10 kHz - 1000 MHz in 15 RF bands, all self-contained — no plug-ins.
- Tracked RF preselection over entire range.
- Built-in 1 min.-to-1 hr. frequency scan for X-Y plotting.
- Matching accessories for all degrees of automation, including computer.
- All major functions remotely controllable.
- Built-in broadband impulse generator for self-calibration.
- Operates from AC or integral 8-hour battery pack with fully-protected charge and discharge.
- Wide dynamic range provided by 60 dB panel meter plus 100 dB step attenuator.
- Up-to-date and field-proven for ruggedness and reliability.

Matching Antennas, Pickups and Related Devices

Antenna/Accessory Kit Model **AAK-25A** includes items marked with asterisk (*). Model **AAK-25B** is same except substitutes BIA-25 for BDA-25. All items also available separately.

***RVR-25:** 41" Vertical Rod Antenna with automatic bandswitching (10 kHz - 25 MHz).

RVA-25: 82" Active Vertical Rod Antenna, 10 kHz - 25 MHz.

***ALR-25:** Magnetic Loop Antenna with automatic bandswitching (10 kHz - 25 MHz).

***BDA-25:** Broadband Dipole Antenna; three fixed lengths cover 20 - 200 MHz.

BIA-25: Biconical Antenna 20 - 200 MHz, per MIL-STD-461/2.

***LCA-25:** Log Conical Spiral Antenna 200 - 1000 MHz per MIL-STD 461/2.

***PCL-25:** Clamp-on Current Probe, 10 kHz - 110 MHz.

***EFP-25:** Electro-Static Probe (Uncalibrated).

***MFA-25/MFB/MFC-25:** Magnetic Field Probes (Uncalibrated).

SU-125: Antenna Switching Unit Controlled by ESC-125A Programmer.

***TRP-25:** Rugged Tripod with bag.

***GPA-25:** Counterpoise for RVR-25 (2' x 2').

*Included in Antenna/Accessory Kit, Model AAK-25A.

Now expanded to CISPR by the CMM-25 Metering Module (10 kHz to 1000 MHz)

Metering Module, Model CMM-25 extends EMC-25 to CISPR measurements 10 kHz to 1000 MHz. Satisfies CISPR publications 1, 2, 3 and 4, plus ANSI C63.2 and C63.3 (to 400 MHz)

Full EMC-25 capability retained, permitting comparison of peak and CISPR quasi-peak response on same signals. Exclusive post-detection circuits provide selecting 10 dB linear or 40 dB logged metering. Feeds both logged quasi-peak and EMC-25 peak to dual-pen plotter.

ESC-125A PROGRAMMER

Electro-Scan Programmer Model ESC-125A Controls EMC-10, EMC-25, X-Y Plotter and SU-125 Antenna Switching Unit, to produce single-sheet X-Y plot of signals 20 Hz - 1000 MHz.

CIG-25 IMPULSE GENERATOR

Calibrated Impulse Generator, Model CIG-25 provides broadband levels 0 to 90 dBuv/MHz. Rep rate variable 1 to 100 Hz. Response ±0.5 dB, 10 kHz to 1000 MHz.

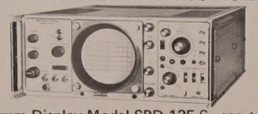
TRF-11 THRU 15 REJECTION FILTERS

Tunable Rejection Filters, Models TRF-11-15 provide 80 dB or more rejection to specific signals, 14 kHz - 1000 MHz.

EXY-125B/250C X-Y PLOTTERS

X-Y Plotter, Model EXY-125B operates with EMC-25 to make octave-band plots, or with added ESC-125A to make multi-band plots. Dual-pen X-Y Plotter, Model EXY-250C makes simultaneous peak and average plots, both formats.

SPD-125 DISPLAY MODULE



Spectrum Display Model SPD-125 Sweep-tunes selected EMC-25 RF band and displays resulting video. Combination is spectrum analyzer with tracking preselection.

Other Accessory Devices

DJB-252: Provides simultaneous peak and average from EMC-25 for X-Y plotting.

***CJB-252:** Control Junction Box permits use of remote antennas.

CLC-252: Provides variable I.G. levels from EMC-25 when battery-powered.

RIM-25: Meter for remote indication of signal level.

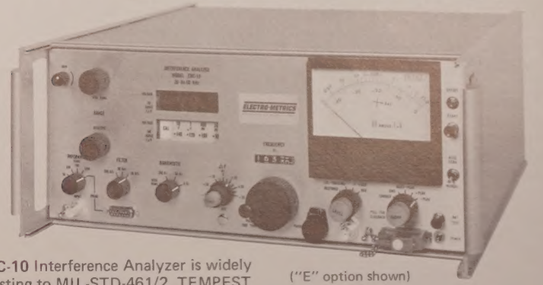
***ICC-25/LAC-25/LVC-25/LCC-25:** Transit cases for EMC-25 and various antennas.

EEM-25/EHF-25: Regular/High Intelligibility Earphones.

EMC-25/MOD II: Modification kit updates early units to Mark II.

*Included in Antenna/Accessory Kit, Model AAK-25A.

EMC-10 the leading Interference Analyzer for 20 Hz to 50 kHz



("E" option shown)

Model EMC-10 Interference Analyzer is widely used for testing to MIL-STD-461/2, TEMPEST and other requirements.

Option A provides automatic frequency control (AFC).

Option B1 substitutes bandwidths of 5, 50, 2500 Hz.

Option B2 substitutes bandwidths of 5, 250, and 2500 Hz.

Option E adds built-in electronic scanning.

- Tunes 20 Hz to 50 kHz in single continuous band.
- AC or rechargeable 8-hour battery operation.
- 170 dB dynamic range including 40 dB on front panel meter.
- Excellent sensitivity combined with crystal-controlled bandwidths of 5, 50, and 250 Hz.
- Wide band operating mode with coverage to 500 kHz or selectable low-pass filters at 20 kHz and 50 kHz.
- Built-in levelled CW source for calibration at any frequency.
- Outputs include "tracking" signal and amplified "restored" signal, both at tuned frequency.
- Voltage tuning provides complete scanning capability for external control.
- Input impedance selectable at 50, 600, 10 k or 100 k ohms.

Available Pickup and Related Devices

ALP-10: Loop Antenna, 25-inch diameter, 20 Hz - 50 kHz.

PEF-10: Active Electric Field Antenna, 20 Hz - 50 kHz.

PCL-10: Clamp-on Probe, 20 Hz - 50 kHz.

LAC-10: Carrying Case for above 3 items and other small accessories.

PCA-10: Amplifier for Clamp-on Probe, (compensating).

ELS-10: Loop Sensor for MIL-STD-461/2 - REO1.

TRI-10: Light-duty Tripod.

TRP-10: Heavy-duty Tripod with Bag.

Other Accessories

ESC-10A: Remote Control and Automatic Scan Unit for EMC-10.

NRF-10/NRG-10: Notch Rejection Filters for 60 Hz/400 Hz.

HPF-10/HPG-10/HPH-10/HPK-10/HPL-10: High-pass Filters for 120/240/1600/300/2000 Hz.

EEM-10/EHF-10: Earphones — regular/high intelligibility.

RIM-10: Remote Meter.

ELECTRO-METRICS
A DIVISION OF PENRIL CORP.
100 Church St., Amsterdam, New York 12010

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INSTRUCTION MANUAL

FOR

INTERFERENCE ANALYZER

MODEL EMC-25

ELECTRO-METRICS
A DIVISION OF PENRIL CORP.
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SECTION I

INTRODUCTION AND SPECIFICATIONS

1.1 THE MANUAL

This manual includes all relevant information for the successful operation, maintenance and repair of Interference Analyzer EMC-25.

1.2 THE EMC-25

The EMC-25 Interference Analyzer is designed for use as the major component of interference analysis systems for the 10 kHz to 1 GHz range. The instrument itself is a programmable selective RF voltmeter, compatible with a wide variety of peripheral equipment. A selection of antennas permits the measurement of radiated electric and magnetic field intensity, while various output devices are available to simplify data reduction and extend the EMC-25's usefulness as a system component.

The EMC-25 is used as an RFI/EMC meter, a field strength meter, a frequency-selective two-terminal voltmeter, and for other applications requiring a highly sensitive, shielded receiving instrument.

Frequency tuning, band selection, internal sweep voltage, impulse generator operation and level, bandwidth selection, detector dwell operation, and vernier gain (Cal) all can be externally programmed. Outputs are provided for the pre-IF and post-IF, DC-coupled AM and FM video, audio, voltage analog of frequency, voltage analog of amplitude, binary band indication, center channel tuning indication, and for the impulse generator.

Instructions for operating accessory equipment are supplied with each accessory. Specific applications are discussed in separate application notes. Field intensities are determined by the simple addition of the calibration factors supplied in the respective instruction manual for the antenna being employed.

1.3 UNPACKING

1.3.1 Remove the instrument carefully from the shipping carton and examine thoroughly for shipping damage. If there is any damage, replace the instrument in the shipping carton and immediately inform the manufacturer and the shipping company of the nature of the damage, the serial number of the instrument, the delivery date, and the invoice number.

1.3.2 Check contents of the carton against shipping slip to be sure that all components and accessory items ordered are present. Notify the manufacturer immediately of any missing items.

1.4 ELECTRONIC SHIPPING DAMAGE

1.4.1 Before leaving the factory, this instrument was subjected to a complete operational check. However, it is possible that electronic damage may have occurred in transit. It is desirable, therefore, to check the operation of the instrument as soon as possible after unpacking.

To do so, perform the calibration tests outlined in paragraph 3.2. If the instrument does not calibrate using the referenced procedures, inform our Customer Service Dept. (518) 843-2600, giving the basic information required in paragraph 1.3.1.

1.5 INSTALLATION

1.5.1 The EMC-25 is designed for bench-top operation, field-portable operation, or for installation in a conventional 19-inch equipment rack.

1.5.2 Rack mounting requires the use of two adapter mounting brackets (ABM-25). Using these brackets, install the instrument by the following procedure. (See Figure 1-1.)

a) Remove the four plastic feet.
b) With six 3/8-inch No. 8-32 binder head screws, fasten brackets to sides of instrument at matching screw holes.
c) Before installing in equipment rack, provide underneath support sufficient to carry the weight of the instrument.

1.6 ELECTRICAL SPECIFICATIONS

1.6.1 FREQUENCY RANGE. The usable frequency range extends from 10 kHz to 1 GHz in 15 bands.

Each band provides a minimum of two percent overlap at each end with respect to adjacent bands.

1.6.2 FREQUENCY ACCURACY. Frequency accuracy is within plus or minus two percent of indicated frequency. (With FINE TUNE control at mid-rotation).

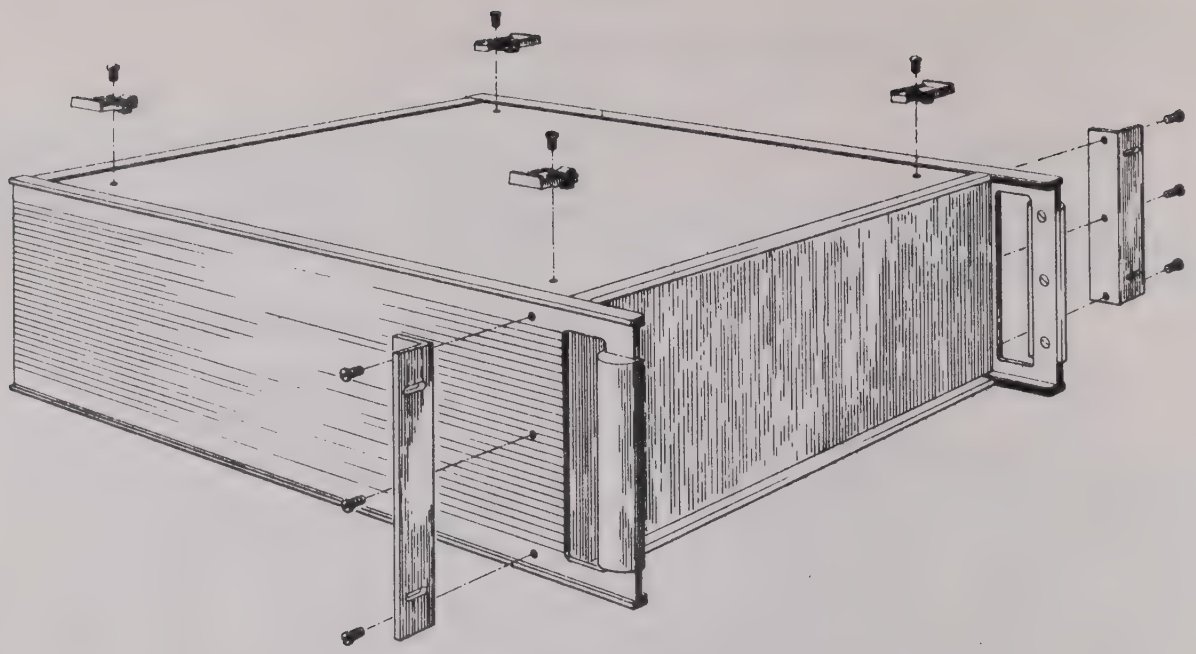


Figure 1.1 Interference Analyzer (Inverted), Installation Drawing

NOTE:
The 4 feet screws are 3/8" NO. 6-32 and the 6 rack mount screws are 3/8" NO. 8-32 Binder Head.

1.6.3 INPUT IMPEDANCE. Input impedance is a nominal 50 ohms.

1.6.4 VOLTAGE ACCURACY. Two-terminal CW voltage measurements, referenced against the internal calibrator, are accurate within ±1.5 dB (top 20 dB of the scale).

1.6.5 SENSITIVITY/BANDWIDTH. Table 1-1 shows the sensitivity and bandwidth of the EMC-25 Interference Analyzer.

1.6.6 SPURIOUS REJECTION. Rejection to Image and IF, and other spurious frequencies typically exceeds 60 dB and is never worse than 45 dB throughout the entire 10 kHz to 1000 MHz range.

1.6.7 VOLTAGE RANGE. The analyzer is capable of measuring signals as large as 1.0 V rms. Voltage ranges are obtained by means of a 20 dB per step attenuator. Overall front panel meter range is 60 dB. Front-end attenuation is inserted in all positions except the most sensitive (0 dB). Remote position is used in conjunction with the programmable attenuator, Model PSA-25/ESC-125 Programmer.

1.6.8 FREQUENCY CONTROL. The analyzer is tunable over any single band by means of a front panel control, or by the application of a suitable voltage to a rear panel connector.

Frequency bands are switched by a dual front panel pushbutton control or, remotely thru J5. Band indication to the remote location is accomplished by means of binary switch closures.

1.6.9 DETECTOR FUNCTIONS

1.6.9.1 CARRIER. Responding to the rms value of an unmodulated sine wave and having nominal 600 milliseconds charge and discharge times.

1.6.9.2 QUASI-PEAK. As in CARRIER except nominal charge time is one millisecond and discharge time 600 milliseconds.

1.6.9.3 PEAK. As in CARRIER except charge time is $\ll$ 1/BW and discharge time is sufficiently long to read an impulse of 1 PPS rep rate with less than 1.0 dB decrease in accuracy.

1.6.9.4 SLIDEBACK. A metered indication of the detector biasing required for aural extinction of signals.

1.6.10 OUTPUTS

1.6.10.1 POST-IF: 1.0 mV rms nominal into 50 ohms.

TABLE 1-1. SENSITIVITY AND BANDWIDTH

BAND	FREQUENCY RANGE	BW (3 dB) NB (Nominal Bandwidths)	BW (3 dB) WB (Nominal Bandwidths)	SENSITIVITY (worst case) *CW (NB) (uV)	SENSITIVITY (worst case) *(IMPULSE (WB) (db/uV/MHz)
1	10.0 kHz – 35.0 kHz	500 Hz	4 kHz	.04	+34
2	35.0 kHz – 75.0 kHz	500 Hz	4 kHz	.04	+33
3	70.0 kHz – 150 kHz	500 Hz	4 kHz	.05	+33
4	120 kHz – 240 kHz	500 Hz	4 kHz	.05	+33
5	240 kHz – 500 kHz	500 Hz	4 kHz	.06	+33
6	0.5 MHz – 1.1 MHz	500 Hz	5 kHz	.06	+32
7	1.1 MHz – 2.4MHz	500 Hz	5 kHz	.06	+32
8	2.4MHz-5.5MHz	5 kHz	50 kHz	.10	+22
9	5.5MHz-12.5MHz	5 kHz	50 kHz	.10	+22
10	12.5MHz-30MHz	5 kHz	50 kHz	.10	+24
11	20MHz-45MHz	50 kHz	500 kHz	0.6	+20
12	45MHz-100MHz	50 kHz	500 kHz	0.8	+20
13	100 MHz – 200 MHz	50 kHz	500 kHz	0.8	+20
14	200 MHz – 500 MHz	50 kHz	500 kHz	1.0	+23
15	500 MHz – 1000 MHz	50 kHz	500 kHz	1.6	+30

* NOTE: Tangential Sensitivity – defined as the internal noise level or as the input signal level required to raise the meter reading 3 dB above the instrument noise. Tangential Sensitivity level is at least 8 dB above minimum discernible signal (MDS). MDS is sometimes defined as being 0.5 dB above the noise level.

1.6.10.2 PRE-IF: 50 uV rms nominal into 50 ohms.

1.6.10.3 VIDEO: 150 mV PEAK nominal into 91 ohms.

1.6.10.4 AUDIO: 100 mV nominal into 600 ohms.

1.6.10.5 RECORDER, External Meter: 1 mA at 1500 ohms.

1.6.10.6 X-Y PLOTTING: Y-Axis 0 to +1.5 VDC nominal into greater than 10 k ohms. X-Axis 0 to +1.5 VDC nominal into greater than 10K ohms.

1.6.11 CALIBRATION. The instrument includes a built-in wideband calibration system.

1.6.12 POWER REQUIREMENTS. AC 105V to 130V or 210V to 260V, 50-450Hz, as well as from an external DC source. Also available, an internal battery, rechargable (option).

1.7 MECHANICAL CONSTRUCTION

The EMC-25 is divided into three major compartments: the main compartment, the power supply and the control section. The instrument is of unit construction using dip-brazed aluminum. Interior assemblies are fastened to the bulkhead and front and rear panels by means of machine screws, and by quarter-turn fasteners to permanently welded fixtures.

SECTION II

THEORY OF OPERATION

2.1 MAIN COMPARTMENT

The main compartment of the EMC-25 houses all the submodules and band turret, etc. which are interconnected to the front and rear panel controls and connectors.

A schematic of the interconnections is shown in Figure 6.1 (Page 6-2) with all necessary connections to front and rear controls and connectors to facilitate maintenance or parts replacement. (Refer to Table 6-1 Page 6-3 EMC-25 Parts List).

The diagram below illustrates the signal flow through the various sections of the EMC-25 Receiver.

2.2 POWER SUPPLY

2.2.1 GENERAL

To permit field operation and to reduce the possibility of ground loops in laboratory work, an optional rechargeable nickel-cadmium battery can be used for the primary power supply. The battery additionally serves the useful purpose of a pre-regulator for AC line operation. In the battery charger compartment are located a constant current supply for charging the battery and a high voltage converter. High impedance of those power lines entering the main circuit section facilitates a high degree of filtering. The low voltage series-regulated power supply and the tuning voltage regulator follow closely conventional practice.

2.2.2 POWER SUPPLY CIRCUIT A5. Refer to Schematic Diagram Figures 6.18 and 6.24.

The power supply is designed to operate the receiver under the following primary power source conditions with a minimum of operator involvement.

A. The receiver may be operated from only its optional internal rechargeable battery, with the receiver unplugged from the AC power source. When plugged into an AC source and the receiver turned off, the battery is automatically charged. A two-step charger with thermal sen-

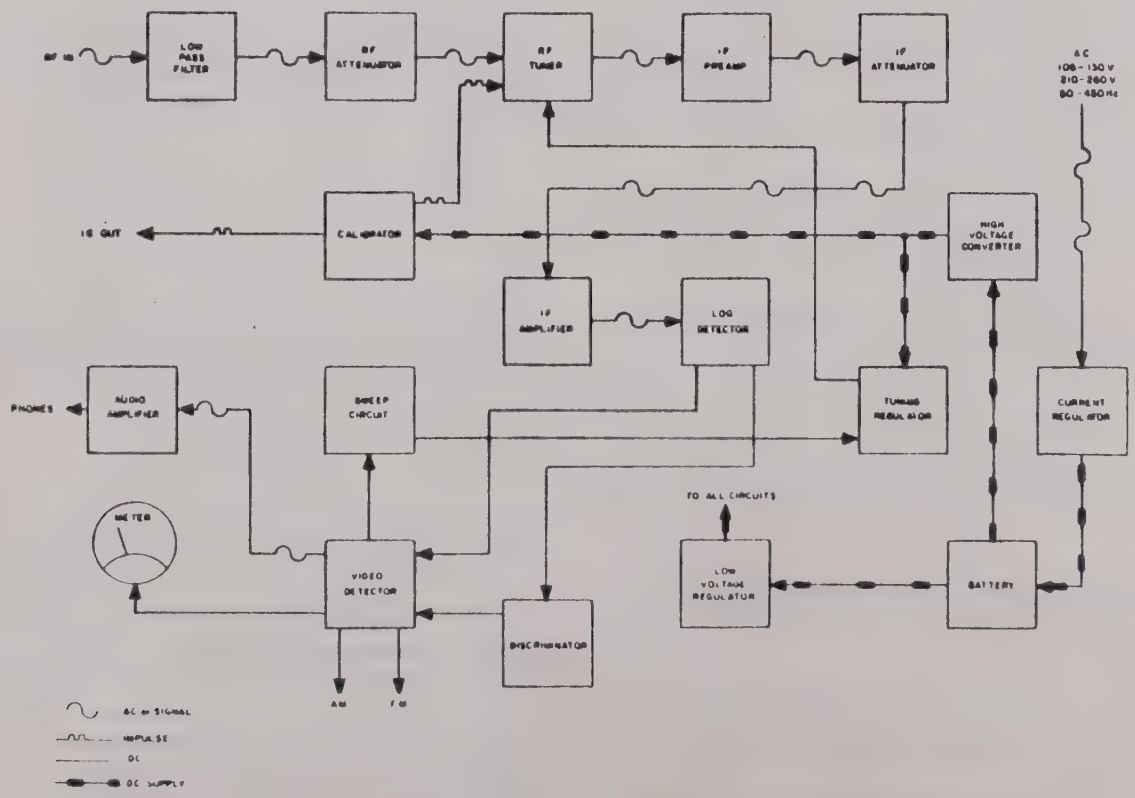


Figure 2.1 Signal Flow Diagram

sors in the battery prevents overcharge if the receiver is constantly plugged in.

B. The receiver operates from a 110V or 220V AC supply of 50Hz to 400Hz. A switch on the rear power supply panel selects either 110V or 220V operation. If the optional internal battery is installed, it serves as a voltage reference for the supply without any battery drain. Two zener diodes establish the reference voltage for the power supply if the battery is not installed.

C. The receiver may be operated from an external DC source of 50V ±5V with 2 amper capacity. Connectors for this input are available on the same connector used for the AC power Cord.

Schematic Diagram Figure #6.24 shows the power supply circuit. The circuitry enclosed within the dotted lines is on the A5P2 printed circuit board, while the other components are chassis mounted.

When operating only from the optional internal battery, the AC bridge rectifier and series supply regulator are not used. The battery's +20 volt output is coupled to the receiver's unswitched negative input. The shunt regulator circuit consisting of U2,Q3 and Q7 is needed, since the battery charging circuit requires a relatively equal discharge from both the positive and negative sides of the battery, while the receiver draws somewhat more current from the positive side of the battery. Since any current imbalance must flow through R22, a 10 ohm resistor in the ground return of the battery, the voltage developed across this resistor is used to detect and correct the imbalance. The normally positive voltage drop across R22 is coupled to the input (pin 2) of an inverting operational amplifier (U2) circuit having a gain of approximately 30DB. The resulting negative output (Pin 6) of U2 is coupled through emitter follower Q3 to the shunt regulator transistor Q7 connected between the negative supply line and ground. The current drawn by Q7 equalizes the current drawn by the battery. Resistor R23 in the emitter circuit of Q7 stabilizes the current drawn by Q7. Current imbalance is therefore reduced to a trickle by the operation of the shunt regulator circuit. When the receiver is connected to an AC supply, (with the receiver turned off), the battery charger is activated. The battery charging rate is controlled by a current source circuit consisting of Q5, CR9, R10 and R12. Current through R10 causes 6.8V Zener reference CR9 to conduct, causing the base of transistor Q5 to be lowered 6.8 volts below the positive supply. Since the emitter of Q5 is connected through resistor R12 to the positive supply, the zener voltage and the 15 ohm resistance of R12 results in a charge current of approximately 400MA. This charge current is cycled on and off through the action of the thermally controlled battery charge control circuit. The input to the charger control circuit is a bridge circuit consisting of resistors R1, R2 and R3 on the printed circuit board A5P1, and two thermistors mounted within the battery pack A5BT1. One of these thermistors is sunk to the battery case, sensing the ambient temperature while the second thermistor samples the cell temperature at the center of the battery pack. There is little temperature rise within the battery while it is charging. However, when it approaches full charge, there is a rapid temperature rise. The resultant temperature differential causes the input bridge circuit to become unbalanced, causing input Pin 5 of U1 to become more positive than input Pin 1. The output at Pin 6 of differential amplifier U1 is driven in a negative direction, causing Q1 to be saturated. The conduction of Q1 shorts out the current source zener reference voltage of CR9, turning off the charging current. Potentiometer R3 in one leg of the input bridge controls the point at which the charger will turn off, by adjusting

the balance of the thermister bridge. It is normally adjusted so that a 3° temperature differential within the battery turns the charger off. With the charger turned off, a trickle charge of approximately 10MA is supplied to the battery through R2, CR19 and CR20. When the receiver is turned on, a switched -12V to the emitter of Q4 saturates it, causing one end of R11 to be grounded. This causes the thermistor bridge to become unbalanced, resulting in the charger being turned off.

AC Operation (with optional internal battery):

The trickle charge provided by R2 maintains the voltage at the base of series regulator Darlington Q6 at two diode drops above the battery voltage. Thus, emitter of Q6, loaded by the receiver circuitry, is maintained at approximately the battery voltage, while the current to operate the receiver is obtained from the output of the bridge rectifier. When large transient currents are drawn from the supply, such as when the rotary solenoid in a remote antenna is activated, the battery may be temporarily used to supply a portion of the current, since a decrease in the output voltage at the emitter of Q6 will cause the switching diode CR21 to become forward biased.

AC operation without the optional internal battery.

This is the same as with battery except for the following:

Zener diodes CR17 (15 volts) and CR18 (24 volts) replace the battery as the reference voltage source for both the series regulator circuit (Q6) and the negative shunt regulator circuit (U2, Q3, Q7). The regulated output voltages are nominally +23 volts and -15 volts compared to the battery regulated +20 volts and -12 volts. A large filter capacitor (C1) is used to store current for large transient currents used during band changes. However, since the large transient currents cause poor supply regulation, the front panel power on indicator light may normally dim during these high-current periods.

DC operation using an external DC supply:

An ungrounded DC supply of 50V ±5 volts with a current capacity of 2 amps is required for external DC operation. The supply is connected between pins E (+) and C (-) of the power input connector of the receiver. Thermal overload protectors S1 and S2 and protective diodes CR14 and CR15 prevent circuit and DC source damage in case of reversed polarity or circuit problems. In the receiver, the DC supply is substituted directly for the DC voltage normally supplied by the bridge rectifier when using AC operation so that the circuit is identical with the AC operation. External DC operation may be used with or without an internal battery.

2.2.3 Protection Against Excessive Discharge

Schematic Figure 6-26, (Pg. 6-34) shows th circuit utilized to prevent the battery pack fron being discharged excessively, possibly to a point a which some of the cells would reverse polarity o be damaged.

As long as battery voltage exceeds 15 volts, the Zener diode, CR 2 type 1N965 conducts, maintaining the base of transistor Q1 at a suitably positive voltage to make it conduct heavily. Relay K1 in its collector circuit is thus normally activated, closing its contacts and allowing the battery current to flow to the various EMC 25 circuits.

However, as soon as the battery voltage drops below 15 volts, the Zener no longer conducts, shutting off Q1, interrupting the coil current to the relay and opening the relay contacts.

As part of this protective circuitry, the front panel power switch, A1S7, is a momentary-contact doublepole double throw switch. Turning the switch to ON, momentarily by-passes the top (+) contacts of the relay and activates Q1 and K1, provided the battery voltage exceeds15 volts. Turning the instrument OFF is accomplished by the switch momentarily shorting together the emitter and base of Q1, thus interrupting the current through the coil of K1 and opening its contacts and cutting

.4 LOW VOLTAGE REGULATOR (A5P3), Figure 6.19, (Page 6-27)

All amplifying circuits in the EMC-25 operate from +12 volt and -6 volt regulated power supplies, with the exception of the audio amplifier P2. The series regulator transistors, A5Q3 for positive supply, and A5Q2 for the negative supply, Fig. 6.18, Page 6-26, are located on the power supply assembly adjacent to A5TB1. Amplifying reference circuits for these supplies are located on A5P3, a plug-in card which is also attached to the power supply assembly. On A5P3, a precision erence diode, CR2, determines the stability of power supplies within the EMC-25. Transistor Q6 senses the difference between the reference tage and the output of the +12 supply as ided by R9 and R10. The amplified difference is applied to the base of Q2, which further amplifies the signal and applies it to an emitter follower, Q1, ich then provides sufficient drive to operate series regulator A5Q3. A 9-volt breakdown diode, CR1, provides proper operating voltages for Q2 Q3. The stability of the power supply is unaffected by CR1. Resistor R8, a factory selected component, provides positive feedback to the wer supply to compensate for variations in tery voltage. The reference for the -6 volt power supply is the +12 volt power supply, therefore, the +12 volt supply must be operating pperly in order for the -6 volt supply to do so. Amplifier Q7 senses the difference between ground and the divided output of the +12 volt and the -6 lt supply as determined by R14 and R15. This plified difference is applied to Q3, which further amplifies and applies it to the emitter follower Q5 which then provides sufficient drive to 5Q2, the series regulator transistor for the -6 volt supply.

.2.5 HIGH VOLTAGE CONVERTER (A5A1)

To supply the regulated 100 volts required by the tuning regulator, and 84 volts for the calibrator, a high voltage converter is located inside the power supply casting to convert the battery voltage to approximately 150 VDC. This converter consists of a class "C" oscillator, operating at 200 kHz. The high voltage converter is sealed, and is not field-repairable. If faulty operation of the converter is encountered, remove the converter from EMC-25 power supply casting and return it to factory for replacement.

2.2.6 TUNING REGULATOR (A5P4) Refer to Figure 6.20 (Page 6-28)

The 0-1.5 VDC tuning voltage enters pin #22 and on to the gate of Q5. Devices Q5 and Q6 are differential amplifiers which feed the inputs of U1, an operational amplifier having a gain of 60 dB. Diodes CR3 and CR4 prevent transients on the low voltage tune line from entering the input of operational amp, U1. The amplifier Q2, amplifies the tune voltage which is fed to emitter followers Q3 and Q4.

The + high voltage is fed to Q3 and Q4 emitter followers which conduct at the proper time, keeping the + high voltage tune line in step with the output of the operational amplifier, U1. Diodes CR5 through CR9 are biased on at the proper level by resistors R18 through R27 so that each diode conducts during a specific portion of the tune voltage curve, thereby feeding a linear tune voltage to the gate of Q6.

The transistor Q7 is a bias voltage source for the diodes. Transistor Q8 is a constant current source for transistors Q5 and Q6. A zener diode CR2 is used to maintain the high voltage tune line at 100 volts. Potentiometer R36, is used to provide a negative offset voltage to assure that the high voltage tune line returns to zero volts on the low end of the tune curve. The high voltage tune line is fed to the turret from pin #3.

2.3 ATTENUATORS

A single control having 20 dB increments is used to adjust the input signal level to the instrument. Both RF and IF attenuation is provided by this control. The first attenuator position avoids RF attenuation and thus provides maximum sensitivity of the instrument, whereas further attenuation steps add RF attenuation to improve the input impedance characteristic and prevent RF overload. Reduction of the noise displayed on the meter results from adding IF attenuation. Table 2-1 lists the amount of attenuation used.

TABLE 2-1 RF & IF ATTENUATION

Atten. Pos.	Attenuation RF dB		IF dB		Total dB
Remote	0	+	14	=	14
0/20	0	+	0	=	0
20/40	6	+	14	=	20
40/60	16	+	24	=	40
60/80	36	+	24	=	60
80/100	56	+	24	=	80
100	76	+	24	=	100

2.3.1 RF TUNER (A2).

Refer to Figure 6.2 (Page 6-10)

The function of the RF Tuner is to select and amplify RF signals, convert these signals to desired IF freq, and preamplify the IF signal.

The frequency range (10 kHz – 1 GHz) of the EMC-25 is covered in 15 bands. The band selection is accomplished by using 15 bandstrips mounted on a rotor in the RF Tuner.

For Bands 1-9, the only components on the bandstrips are RF and LO transformers, coils, buffer and padder capacitors, loading resistors, and coupling capacitors.

For Band 10-15, part or all of the active RF circuitry is mounted on the bandstrip. This is done to minimize lead lengths and stray capacities at the higher frequencies.

In Bands 3, 4 and 13-15, double conversion is used to improve image rejection and other characteristics. Table 2-2 shows the IF frequencies and LO frequencies for all bands.

A Stator Board is mounted adjacent to the rotor. This printed circuit board contains the components not included in the rotor to complete the circuitry required for tuning. Connections are made between the bandstrips on the rotor and the Stator Board by means of thirty nickel-plated spring contacts.

2.4 BANDS 1-9 (A2A1, 1-9) Except Bands 3 and 4.

Refer to Fig. 6.4 (Page 6-12)

The operation of Bands 1-9 can be seen by following the signal flow through Band 1. Figure 6.2 RF Tuner (A2) is a schematic drawing of the Stator Board with Band 1 bandstrip in position. Figure 6.4 is the schematic for Bandstrips 1-9.

The RF signal comes from the Calibrator Assembly (A1A2) through a semi-rigid coaxial cable. This coaxial cable center conductor is connected to pin 2 of the contact strip of the Stator Board. Pin 1 and Pin 3 are used as ground points for the coaxial cable. The signal passes through Pin 2 to the untuned primary of T0101 on the bandstrip. The untuned primary presents a nominal 50-ohm impedance at the frequency to which the receiver is tuned. T0101 is a voltage step-up transformer with a tuned secondary. The secondary of T0101 is tuned by voltage variable capacitors which are mounted on the Stator Board and are connected to the secondary of T0101 through Pin 4 and Pin 6. The secondary of T0101 is also tuned by the buffer capacitor C1, mounted on the bandstrip. C1 is a tracking adjustment used only in the initial setup of the band. Voltage variable capacitors CR1 and CR2 tune T0101 over the frequency range of the bandstrip.The tuning voltage for CR1 and CR2 is derived from the Tuning Regulator (A5P4).

The voltage variable capacitors mounted on the Stator Board, CR1, CR2, etc., are actually two voltage variable capacitors CR1A and CR1B connected in series. The series connection is required to prevent large RF signals from changing the DC bias voltage at low tuning voltages and thus detuning the circuit.

Bands 1-7 use CR1 and CR2 in parallel to obtain a higher capacitance for tuning. Bands 8 and 9 use only CR1 since a low capacitance is sufficient.

The gate of the field effect transistor, Q1, mounted on the Stator Board is connected to the secondary of T0101 through Pin 5. The gate of the field effect transistor is a high impedance. The function of T0101 is to transform this impedance to the 50-ohm input impedance and at the same time, it is a tuned circuit which provides preselection. The diodes CR3 and CR4, that are connected to the gate of Q1 provide over-voltage protection.

The field effect transistor, Q1, and the bipolar transistor, Q2, are a cascode RF amplifier. Their function is to amplify the RF signal. The signal goes from the collector of Q2 to the double-tuned circuit on the bandstrip used for preselection; selectivity of the double-tuned circuit is higher than for a single-tuned circuit.

The collector supply voltage for Q2 comes from Pin 10 through L0102 on the bandstrip to Pin 8. Voltage variable capacitor CR5 is connected to L0102 thru Pin 9, and CR6 on the Stator Board is connected through Pin 11. CR5 and CR6 are the main tuning for L0102 and derive their tuning voltage from the same point as CR1 and CR2. Buffer capacitor, C2, on the bandstrip is a tracking adjustment.

Voltage variable capacitor, CR7, on the Stator Board is connected to L0103 through Pin 13. Voltage variable capacitor CR8 on the Stator Board is connected to L0103 thru Pin 15. CR7 and CR8 are the main tuning for L0103 and derive their tuning voltage from the same point as CR1 and CR2. Buffer capacitor, C5, is a tracking adjustment for L0103.

The RF signal output from the double tuned circuit comes from the voltage divider at Pin #16 on the bandstrip. The RF signal output goes through Pin 16 to the gate of the field effect transistor Q3 on the Stator Board. Field effect transistor Q3 and transistor Q4 are a unity gain impedance converter. Their function is to increase the impedance of Q5 so that the double-tuned circuit is not loaded too heavily.

Transistors Q5 and Q6 on the Stator Board constitute a balanced mixer which mixes the RF signal and the local oscillator signal to generate an IF signal. A balanced mixer is required in order to cancel any local oscillator signal at the output of the mixer, since at the low frequency end of Band 1, the local oscillator frequency is very close to IF frequency.

TABLE 2-2

INPUT AND LO FREQUENCIES

BAND	INPUT FREQ.	IF FREQ.	1st LO FREQ.	2nd IF FREQ.	2nd LO FREQ.
1	10-35 kHz	175kHz	185-210 kHz		
2	35-75 kHz	175 kHz	210-250 kHz		
3	70-150 kHz	1.6 MHz	1.670-1.750 MHz	175 kHz	
4	120-260 kHz	1.6 MHz	1.72-1.86 MHz	175 kHz	1.425 MHz
5	240-520 kHz	175 kHz	415-695 MHz		
6	.48-1.10 MHz	175 kHz	.655-1.275 MHz		
7	1.05-2.4 MHz	175 kHz	1.180-2.575 MHz		
8	2.30-5.3 MHz	1.6 MHz	3.9-6.9 MHz		
9	5-11.4 MHz	1.6 MHz	6.6-13.0 MHz		
10	11-25 MHz	1.6 MHz	12.6-26.6 MHz		
*11	24-51 MHz	8.7 MHz	32.7-59.7 MHz		
*12	50-102 MHz	8.7 MHz	58.7-110.7 MHz		
13	100-215 MHz	38.7 MHz	138.7-253.7 MHz	8.7 MHz	30.0 MHz
14	210-500 MHz	68.7 MHz	278.7-568.7 MHz	8.7 MHz	60.0 MHz
15	490-1000 MHz	98.7 MHz	588.7-1098.7 MHz	8.7 MHz	90.0 MHz

* For Model EMC-25RX, coverage will be 20 MHz – 45 MHz and 45 MHz – 102 MHz, with 1st LO ranges 28.7 – 53.7 MHz and 53.7 – 110.7 MHz, respectively.

Transistors Q5 and Q6 are matched for V_{BE} and H_{FE} so that their gain and mixing characteristics are nearly identical. The RF signal is injected from the source of Q3 to the emitter of Q5 and the base of Q6.

The RF signal is introduced at the emitter of Q5 and the base of Q6 and LO signal at the base of Q5 and the emitter of Q6. RF and LO signals introduced at the bases produce collector currents 180° out-of phase with the input signals. Signals applied to the emitters produce in-phase collector currents components. As the collectors of Q5 and Q6 are connected together, the collector currents produced by RF signals will be out-of-phase and equal in amplitude, causing cancellation at this point. LO signals will be similarly cancelled.

The IF signals generated in the emitter base junction of Q5 and Q6 are identical, so IF signals at the collectors of Q5 and Q6 are additive. The transformer T2001 and capacitor C51 in the collector of Q5 and Q6 is a tuned circuit tuned to the 175 kHz, one of the IF frequencies. This tank circuit is connected to the collector of Q5 and Q6 through diode switch CR9. Bandstrips utilizing the 175 kHz IF have a jumper wire on the bandstrip connecting Pin 20, a +12V point, to Pin 17; this causes CR9 to conduct which connects the 175 kHz IF signal. It then is taken from the secondary of T2001 and connected to TP2 on the Preamp Board through a coaxial cable.

The transformer T3001 and capacitor C52 in the collector of Q5 and Q6 is a tuned circuit tuned to 1.6 MHz. This tank is connected to the collector of Q5 and Q6 by the diode switch CR10. Bandstrips utilizing the 1.6 MHz IF have a jumper wire on the bandstrip, a +12V point; this causes CR10 to conduct which connects the 1.6 MHz tuned circuit to the collector Q6. The 1.6

MHz IF is taken from the secondary of T3001 and connected to TP3 on the Preamp board through a coaxial cable.

Refer to Table 2-2 for the IF frequency used with each bandstrip.

The local oscillator signal is generated by transistor Q11 on the Stator Board. The tuned circuit for the oscillator is on the bandstrip. The oscillator is a Hartley configuration. The primary of T0704 is the inductance for the tuned circuit and is connected to the collector of Q11. Feedback for the oscillator is taken from a tap on the primary coil and connected to the emitter of Q11. The primary coil is tuned to the emitter of Q11. The primary coil is tuned by voltage variable capacitors CR11 and CR12 on the Stator Board.

The local oscillator output is taken from the secondary of T0704 and passes to the gate of field effect transistor Q8. Transistor Q8 and transistor Q7 form a unity gain impedance converter similar to Q3 and Q4. The local oscillator signal is coupled from the source of Q8 to the emitter of Q6 and the base of Q5, the mixer transistors.

Band 1-9 Local Oscillator Operation

The Local Oscillator for Bands 1-10 are similar except for frequency. The operation of the Local Oscillator can be seen by following the operation of the Band 1 LO. Q11, on the Stator Board is the oscillator transistor. The collector of Q11 drives the parallel tuned circuit consisting of the primary T0104, on the bandstrip and voltage variable capacitors CR11 and CR12 on the Stator Board. The feedback signal comes from the tap on the primary of T0104 and goes to the emitter of Q11. This oscillator is in a Hartley configuration. The output signal from the oscillator comes from the secondary of T0104.

2.5 BAND 10 (A2A1, 10)
Refer to Fig. 6.5, (Page 6-13)

The operation of Band 10 is similar to Bands 1-9 except, due to lead length consideration, the whole RF amplifier is on the bandstrip. Referring to Figure 6-5, Band 10 Schematic Diagram, the RF signal passes through Pin 2 to the untuned primary of T1. T1 is a voltage step-up transformer and the secondary is tuned by voltage variable capacitors CR1, CR2, CR3, and CR4 on the bandstrip. The secondary of T1 is connected to the gate of Q1. Transistors Q1 and Q2 are the 1st RF amplifier. They are connected in a doublet configuration which utilizes the g_m of Q1 and the beta of Q2 for gain. The collector of Q2 drives a single tuned tank which consists of the primary of T2 and voltage variable capacitors CR5, CR6, CR7 and CR8. The RF signal is taken from the secondary of T2 and goes to the base of Q3. Q3 and Q4 are the 2nd RF amplifier and are connected in a cascode configuration. The collector of Q4 drives the double-tuned bottom coupled network consisting of L1 and L2. L1 is tuned by voltage variable capacitors CR9, CR10, CR11, and CR12. L2 is tuned by voltage variable capacitors CR13, CR14, CR15 and CR16. The double-tuned network is bottom coupled using C16 and lead inductance as the coupling reactance. The RF signal output is taken from L2 through R22 and Pin 16 to the Stator Board. The signal passes through Q3 and Q4 to the signal injection point of the mixer Q5 and Q6. The local oscillator for Band 10 operates in the same manner as in Band 1-9.

2.6 BAND 11 (A2A1, 11)
Refer to Fig. 6.6, (Page 6-14)

Band 11 is self-contained in the bandstrip except for the mixer. Referring to Figure 6.6, Band 11 Schematic Drawing, the RF signal passes through Pin 2 to a tap on the primary of T1. The primary of T1 is tuned by voltage variable capacitor, CR1.

The RF signal passes from the untuned secondary of T1 to the base of Q1. Transistors Q1 and Q2 are the 1st RF amplifier connected in a cascode configuration. The collector of Q2 drives the tuned circuit of L1 tuned by voltage variable capacitors CR2 and CR3. The collector of Q2 drives L1 at a tap point and is also the output of the 1st RF amplifier. The RF signal drives the base of Q3. Q3 and Q4 are connected in a cascode configuration and are the 2nd RF amplifier. The collector of Q4 is connected to the primary of T3. The primary of T3 is tuned by voltage variable capacitors CR4 and CR5. The RF signal output comes from the secondary of T3 and passes through Pin 19 to the signal injection point of the mixer for the 8.7 MHz IF on the Stator Board.

Referring to Figure 6.2, the RF signal comes from Pin 19 to the base of Q9, the mixer for 8.7 MHz IF. The local oscillator signal comes from Pin 21 to the emitter of Q9. The 8.7 MHz IF signal is generated in the collector of Q9. The primary of T4001 is connected to the collector of Q9 and is tuned by C56. The IF signal comes from the secondary of T4001 and goes to TP5 on the Preamp Board through a coaxial cable.

Referring to Figure 6.6, Band 11 Schematic Diagram, Q6 is the local oscillator. Q6 is in a common emitter configuration with the collector connected to the primary of T4. The primary of T4 is tuned by voltage variable capacitors CR6 and CR7. C39 is a tracking adjustment. The feedback for the oscillator comes from an inverting winding on T4 and goes through R26 and C42 to the base of Q6. The local oscillator output from the secondary of T4 drives the buffer amplifier Q5.

The output of the buffer amplifier passes through Pin 21 to the emitter of A2Q9, the 8.7 MHz mixer.

2.7 BAND 12 (A2A1, 12)
Refer to Fig. 6.7, (Page 6-15)

Band 12 is a self-contained bandstrip which operates in a similar manner to Band 11, Figure 6.7.

The RF amplifiers for Band 12 are similar in operation to Band 11. The mixer and mixer injection is also the same as in Band 11.

Q5 is the local oscillator connected in a common emitter configuration. The collector of Q5 is connected to the primary of T4. The primary of T4 is tuned by voltage variable capacitor CR6. The feedback for the oscillator comes from the collector of Q5 through a phase shift network consisting of C37, L5, CR7, CR8, and the input impedance of Q5. CR7 and CR8 are voltage variable capacitors. The local oscillator output comes from the secondary of T4 through Pin 21 to the emitter of A2Q9, the 8.7 MHz mixer on the Stator Board.

2.8 BAND 13 (A2A1, 13)
Refer to Fig. 6.8 (Page 6-16)

Band 13 is a self-contained bandstrip, except for the second mixer circuit which is on the Stator Board.

Referring to Figure 6.8, Band 13 Schematic Diagram, the RF signal enters the bandstrip at Pin 2. The RF signal goes from Pin 2 to the tap of L2, a 50-ohm impedance point at the tuned frequency. L2 and voltage variable capacitors CR1, CR2 and C1 form the input parallel resonance circuit. The output is developed across a tap of L2 and goes to the base of transistor Q2. The collector of Q2 drives the tap of L3. L3 and voltage variable capacitor CR5 and capacitor C7 form a parallel, resonant circuit for the output of the 1st RF amplifier. One side of L3 is AC grounded through C47 and the other side of L3 is AC coupled through C8 to CR5 and C7. The output of this tuned circuit goes from the collector of Q2 through the coupling capacitor C9 and R17 to the base of Q5, the 2nd RF amplifier. The collector of Q5 drives a tap on L9. L9, voltage variable capacitor CR8, and capacitor C18 form a parallel resonant circuit. One end of L9 is AC grounded through C60; the other end is AC coupled through C20 to CR8 and C18. The output of the tuned circuit goes from the collector of Q5 through C21 and R28 to the emitters of Q8 and Q9, which form a balanced mixer.

In order to achieve the proper image rejection, Band 13 is double converted. The 1st mixer is Q8 and Q9. The 1st LO signal comes from voltage variable oscillator, Q4. Q4 is in a common emitter configuration. The collector is tuned by the parallel resonant circuit formed by the primary inductance of T1, C12, and voltage variable capacitors CR6 and CR7. The feedback path is from the collector through the phase shift network consisting of L6, voltage variable capacitors CR3 and CR4 and L5, to the base of Q4. The 1st LO output goes from the secondary of T1 to the base of Q7. The LO signal at the emitter of Q7 drives the base of Q8. The LO signal at the collector of Q7, which is 180° out-of-phase with the signal at the emitter of Q7, drives the base of Q9. The RF signal is applied to the emitters of Q8 and Q9. The series-tuned circuit formed by L16, C44 and C45 in the emitter of Q8 and Q9 is resonant at the 1st IF frequency of 38.7 MHz. This circuit is used to improve the IF rejection of the bandstip. The collectors of Q8 and Q9 drive the parallel resonant circuit formed by the primary inductance of T2 and capacitors C24, C25, and C26. This circuit is resonant at the 1st IF frequency of 38.7 MHz. The output of the mixer circuit goes from the secondary of T2 to the base of Q10, the 1st IF buffer amplifier. The collector of Q10 drives the parallel-resonant circuit formed by the primary inductance of T3 and capacitor C29. One end of the primary of T3 is AC grounded through C31. This circuit is resonant at the 1st IF frequency of 38.7 MHz. The output of the 1st IF buffer goes from the secondary of T3, through Pin 19 to the 8.7 MHz mixer on the Stator Board. This mixer is used for final conversion to 8.7 MHz.

The LO signal for the 8.7 MHz mixer is provided by the 30 MHz Crystal Oscillator Q12. Q12 is in a Colpitts configuration with the collector driving the parallel resonant circuit consisting of the primary inductance of T4, and capacitors C36, C37, and C38. The feedback signal goes from the junction of C37 and C38, through crystal Y1, to the emitter of Q12. The base of Q11, the LO buffer amplifier is coupled to the LO oscillator through the secondary of T4. The output of Q11 goes from the collector through Pin 21 to the 8.7 MHz mixer on the Stator Board. Q13 and associated circuitry are for units with LO output option only.

2.9 BAND 14 (A2A1, 14)
Refer to Fig. 6.9, (Page 6-17)

Band 14 is a self-contained band and operates in the following manner:

Referring to Figure 6.9, Band 14 Schematic Diagram the RF signal enters the bandstrip through Pin 2, and goes to the tap on L1. L1 and voltage variable capacitor CR1 form a parallel resonant circuit. The signal goes from the tap on L1 to the base of Q1, the 1st RF amplifier. The signal goes from the collector of Q1 to the tap on

L5. L5 and voltage variable capacitors CR3 and CR4, form a parallel resonant circuit.

The output of the tuned circuit goes from the tap on L5, through R6 and C4 to the base of Q2, the 2nd RF amplifier. The signal goes from the collector of Q2 to L8. L8 and voltage variable capacitors CR5 and CR6 form a parallel resonant circuit. The output goes from the tap on L8, through R11 to the emitter of Q5, the RF buffer amplifier. The output of Q5 goes from the collector to the emitter of Q4. Q4 and Q6 form the 1st mixer.

Like Band 13, Band 14 has a double conversion.

The first LO signal comes from voltage variable oscillator, Q3. Q3 has a grounded base and the collector is tuned by the parallel resonant circuit consisting of L12 and L11 in parallel and voltage variable capacitors CR8 and CR9. The feedback signal goes from the tap of L11 through voltage variable capacitor CR7 to the emitter of Q3. The LO output goes from the tap on L11 through R21 to the base of Q4.

Q4 and Q6 are in a cascode configuration and form the 1st mixer. The signal is applied to the emitter of Q4 and the 1st LO is applied to the base of Q4. The 1st IF signal, 68.7 MHz, goes from the collector of Q6 to the parallel resonant circuit formed by the primary inductance of T1 and C22. This circuit is resonant at the 1st IF frequency. The 1st IF signal goes from the secondary of T1 through R28 to the base of Q7 and also through R40 to a tap on L16. L16 and C24 form a parallel resonant circuit at 68.7 MHz. This circuit is used to improve the 1st IF selectivity. Q7 is an amplifier at the 1st IF frequency 68.7 MHz. The collector of Q3 is connected to the parallel resonant circuit formed by the primary inductance of T2 and C25. The output is taken from the secondary of T2 and goes through R39 and Pin 19 to the 8.7 MHz mixer on the Stator Board which acts as the second mixer in the double conversion.

The 2nd LO signal comes from the 60 MHz Crystal Oscillator, Q8, on the bandstrip. Q8 is in a Colpitts configuration. The collector goes to the parallel resonant circuit formed by L22, C29, C30, and C31. The feedback signal goes from the junction of C31 and C29, thru coil L22, C27, R36 and C26 to Pin 21 out to the Stator Board.

Q9 and associated circuitry are for units with LO output option only.

2.10 BAND 15 (A2A1, 15)
Refer to Fig. 6.10, (Page 6-18)

Band 15 is a self-contained bandstrip and operates in the following manner:

Referring to Figure 6.10, Band 15 Schematic Diagram, the RF signal goes through Pin 2 to the input coupling loop of the first voltage tunable bandpass filter. There is a series-resonant circuit from the input to the ground. The circuit consists of L1, C1, C54 and voltage-variable capacitors CR1 and CR2. The circuit is resonant at the image frequency and acts as an image trap.

The voltage tunable bandpass filter is tuned by voltage variable capacitor, CR3. The signal goes from the output coupling loop through C6 to the base of Q1. Q1 and Q2 form a direct-coupled broadband amplifier, whose output is fed through C9 to the input coupling loop of the second voltage-tuned bandpass filter, which is tuned by the voltage-variable capacitor CR4. The output of Q3 is coupled through C17 and R12 to the input loop of the third voltage-tunable bandpass filter. This filter is tuned by the voltage-variable capacitor CR5.

The three voltage-tunable bandpass filters provide the RF selectivity for the bandstrip.

The signal goes from the output coupling loop of the third bandpass filter, through R20, to the base of Q5, a broadband RF amplifier. The output of Q5 is coupled through C33 to the emitter of Q8. Q7 and Q8 are in a cascode configuration which forms the 1st mixer.

The IF output is taken from the collector of Q7 and fed to a resonant circuit consisting of the primary of T2, C40 and C55. This circuit is tuned to the 1st IF frequency, (98.7 MHz). The secondary of T2 couples the IF signal thru R37 to the base of Q6, the 1st IF amplifier. Transformer T1 in the collector of Q6 is also tuned by means of C37, to 98.7 MHz. The output of this amplifier is coupled by means of the secondary of T1, thru R31 and Pin 19 of the bandstrip to the 8.7 MHz, 2nd mixer on the stator board.

The local oscillator signal for the 1st mixer comes from the voltage-variable oscillator, Q9. A9 has a grounded base, and the collector is tuned by the parallel resonant circuit consisting of L16, in parallel with voltage-variable capacitors CR6 and CR7. The feedback signal goes from the tap on L16 through voltage-variable capacitor CR8 and C52 to the emitter of Q9. The LO output signal goes from the emitter of Q9, through a coaxial cable, and through C39 and R39, to the base of Q8, the 1st mixer. The collector of Q6, 1st IF amplifier, is tuned to the IF frequency of 98.7 MHz by the parallel resonant circuit consisting of the primary inductance of T1 and C37.

The local oscillator signal for the second mixer comes from the 90 MHz Crystal Oscillator, Q9. A9 has a grounded base, and the collector is tuned by the parallel resonant circuit consisting of L16, in parallel with voltage-variable capacitors CR6 and CR7. The feedback signal goes from the tap on L16 through voltage-variable capacitor CR8 and C52 to the emitter of Q9. The LO output signal goes from the emitter of Q9, through a coaxial cable, and through C39 and R39, to the base of Q8, the 1st mixer. The collector of Q6 1st

IF amplifier is tuned to the IF frequency of 98.7 MHz by the parallel resonant circuit consisting of the primary inductance of T1 and C37.

The local oscillator signal for the second mixer comes from the 90 MHz Crystal Oscillator Q4, a Colpitts configuration. The collector is tuned by the parallel resonant circuit consisting of L11, C20, C24, and C25. The feedback signal goes from the junction of C20 and C21, through the crystal Y1, to the emitter of Q4.

The local oscillator signal goes from the tap on L11 through C27, a coaxial cable, and Pin 21 to the 8.7 MHz mixer on the Stator Board.

Q10 and associated circuitry are for units with LO output option only.

2.11 PREAMPLIFIER (A2A2)
Refer to Fig. 6.3, (Page 6-11)

Bands 1-7 use an IF frequency of 175 kHz. The IF output of the mixer on the Stator Board goes to TP1 on the Preamp Board. TP1 is connected to the untuned primary coil of T2002. T2002 is a voltage step-up transformer, with the secondary tuned to 175 kHz by C7. The IF signal comes from the tap on the secondary coil of T2002 and goes to the base of Q2, an emitter follower. A switch on the rotor of the RF Tuner controls the -6V for the 175 kHz Preamp. When the proper bandstrip is in position, a -6V is applied to "175 kHz -6V" terminal on the Preamp Board. This biases Q2 on and causes the diode switch CR6 and CR7 to conduct. The 175 kHz IF signal then goes from the emitter of Q2 through CR6 and CR7 to the base of Q5.

Bands 8-10 use an IF frequency of 1.6 MHz. The IF output of the mixer on the Stator Board goes to TP3 on the Preamp Board. TP3 is connected to the untuned primary coil of T3002. T3002 is a voltage step-up transformer, with the secondary coil tuned to 1.6 MHz by C2. The IF signal comes from the tap on the secondary coil of T3002 and goes to the base of Q3, an emitter follower. When the proper bandstrip is in position, -6V is applied to the "1.6 MHz -6V" terminal on the Preamp Board. This biases Q3 on and causes the diode switch consisting of CR2, CR3, CR4 and CR5 to conduct. The 1.6 MHz IF signal goes from the emitter of Q3 through the diode switch to the base of Q5.

Bands 3 and 4 utilize a final IF frequency of 175 kHz, but since 175 kHz is also an RF input frequency to the band, Bands 3 and 4 are double converted. The 1st IF frequency, 1.6 MHz, is generated in the mixer on the Stator Board. The 1.6 MHz, IF signal on Band 3 & 4 follows the same path as the regular 1.6 MHz IF signal, except when Band 3 or 4 is in position, -6V is applied to "CONVERTER -6V" terminal on the Preamp Board. This energizes the 1.425 MHz, crystal oscillator, Q1. The oscillator output is taken from the secondary coil of T5001, and is applied across CR2, CR3, CR4 and CR5. In this mode of operation diode switch CR2, CR3, CR4 and CR5 becomes the second mixer generating 175 kHz. The output of the second mixer goes to the base of Q5.

Bands 11-15 use a final IF frequency of 8.7 MHz. The IF frequency comes from the mixer on the Stator Board and goes to TP5 on the Preamp Board. The IF signal goes to the untuned primary coil of T4002. T4002 is a voltage step-up transformer and the secondary coil is tuned to 8.7 MHz by C1. The IF signal is taken from a tap on the secondary coil of T4002 and goes to the base of Q4, an emitter follower. When the proper band is in position, -6V is applied to the "8.7 MHz -6V" terminal on the Preamp Board. This turns Q4 on. The IF signal then goes from the emitter of Q4 to the base of Q5.

Q5, Q6, and Q7 form a variable gain wideband amplifier. This amplifier has a bandpass from below 175 kHz to above 8.7 MHz, covering all three IF frequencies and is common to all three. The gain of this amplifier is varied by light-variable resistors RX1 and RX2 in the emitter circuit of Q5. These elements are connected in parallel and determine the gain of the amplifier in conjunction with R31, the feedback resistor. The resistance of the signal elements of RX1 and RX2 is varied by the current in control elements within RX1 and RX2. The control current for RX1 and RX2 comes from the "CAL" control on the front panel of the receiver to the "GAIN" terminal on the Preamp Board. The control signal then goes through a dual emitter follower, Q8 and Q9 providing temperature compensation. The control signal goes from the emitter of Q9 to the control elements of RX1 and RX2 in series. This yields approximately 20 dB of gain control and is used to calibrate the receiver.

The output of the wideband amplifier comes from the emitter of Q7. The IF signal goes from the emitter of Q7 through R34 to relays K-1 and K-2, and resistors R34, R38, R39, R43, and R44 to form the IF step attenuator. The IF step attenuator is electrically controlled by the RF step atten. Their values are such that each step of the front panel control gives an overall of 20dB attenuation, but as the attenuation is increased from 0dB position, the noise level on the meter decreases increasing the dynamic range (Fig.6.3) The output of the IF Atten. goes to conn. A2J3 on the RF Tuner housing. The IF signal then goes through a coaxial cable to A3J1 on the IF Amplifier Assembly.

The output of the IF step Atten. also goes to the base of Q10, an emitter follower with the output at the emitter. This signal goes through R41 to connector A2J2 on the RF Tuner

housing. This signal is the PRE IF OUTPUT and goes from A2J2 through a coaxial cable to A1J101 on the rear receiver housing.

2.12 IF AMPLIFIER (A3)
Refer to Fig. 6.11, (Page 6-19)

The EMC-25 uses three different final IF frequencies and three IF amplifiers. Each IF amplifier has a similar selectivity curve and configuration. The IF selectivity curve in the WIDE BANDWIDTH position is that of five under-coupled doubled-tuned circuits with a coupling coefficient of 0.85.

Although the center frequency the bandwidth, and the gain of each IF amplifier is different, operation of all the IF amplifiers is basically the same.

An IF signal comes from A2J3 on the Preamp Board to A3J1 on the IF Amp. The switch mounted on the rotor in the RF Tuner turns on the proper IF strip by applying -6V to the proper IF (eg. "8.7 MHz -6V" turns on the 8.7 MHz IF amplifier while the other IF amplifiers stay off).

The 8.7 MHz IF signal goes from A3J1 through C1, L4001, and R1 in series to the emitter of Q1. C1 and L4001 are series resonant at 8.7 MHz and present a 50-ohm impedance to J1. This series tuned network, the tank circuit at the input to the preamp, and the tank circuit at the output of the mixer on the Stator Board, are equivalent to one double-tuned network.

Q1 is the 1st stage of IF amplification. The collector of Q1 is tuned by a double-tuned under-coupled network consisting of L4002 C5, the primary inductance of T4004, and C6. Capacitor C4 is the coupling reactance. This network is top coupled and each half has an equal Q factor. Q4 and the unloaded Q of L4002 determine the circuit Q of the 1st half. R5, the unloaded Q of T4003, and the load resistance reflected from the secondary of T4003 determine the circuit Q of the 2nd half.

Each amplifier stage operates in the same manner and is double-tuned and under-coupled to successively increase the "Q" factor to present the proper bandwidths to the Log Detector.

When the "BANDWIDTH" switch on the front panel of the receiver is in the WIDE position the "Bandwidth Command" voltage is -6V. This causes diode switches CR1 and CR3 to be open (off) and diode switch CR2 to conduct in the on position. Then the output of the 1st stage goes from the secondary of T4003 through CR2 to the emitter of Q4, the 2nd stage of IF amplification.

When the BANDWIDTH switch is in the NARROW position, the "Bandwidth Command" voltage is +12V. This causes diode switches CR1 and CR3 to conduct, or to be in the on position and diode switch CR2 to be open or in the off position. Then the output of the 1st stage goes from the secondary of T4003 through CR1 and R6 to the emitter of Q2. The single tuned circuit in the collector of Q2 determines the NARROW bandwidth. The tank consists of L4004 and capacitor C12. R11 is the loading resistor. The output of the tank goes through R12 to the gate of the source follower Q3. The output of Q3 goes from the source through CR3 to the emitter of Q4, the second stage. The tank in the collector of Q2 has a very high Q. R11 is factory adjusted for the proper narrow bandwidth. R6 is factory adjusted so that the gain in NARROW band is the same as in WIDE band.

The output of the last stage of each channel goes to an emitter follower, Q7, that presents the proper impedance match to the Log Detector. A lower level signal is also delivered from the emitter follower to the POST IF OUTPUT.

The outputs of all three channels are combined through A3A1 (R32), A3A2 (R33) and A3A3 (R32) and go to J3. This output, the POST IF OUTPUT, then goes through a coaxial cable to A1J102 on the rear of the receiver.

2.13 "N" OPTION
(Crystal Filter, A10, Fig. 6.22)

The "N" Option to the EMC-25 consists of an internally mounted crystal filter to provide a third, narrower bandwidth, Figure 6.22. This filter is located in a shielded housing within the EMC-25 main compartment. It shapes the bandpass response characteristic to a 4-pole Gaussian response. The normally supplied ultra narrow bandwidth is nominally one percent of the wide bandwidth and ten percent of the narrow bandwidth.

The filter assembly consists of three IF channels (175 kHz, 1.6 MHz, and 8.7 MHz) corresponding to the three IF frequencies of the EMC-25, each channel having a crystal filter and an amplifier. It is located in the circuit between the IF Amplifier and Log Detector. When correctly adjusted, the overall insertion loss through the filter operation is 0 dB which allows the gain characteristic of the EMC-25 receiver to remain unchanged.

2.14 CONTROL PARAMETERS FOR "N" OPTION
Refer to Fig. 6.22, (Page 6-30)

The front panel BANDWIDTH switch selects voltages supplied to the 0.1 NB Command line; +12 volts is applied in the 0.1 NB position and an open circuit in the NB position. +12 volts supplied to the filter stage will forward bias CR1, CR4 and CR7 and back bias CR2, CR3, CR5, CR6, CR8, and CR9 allowing signals from the quartz crystal filter to be connected to the amplifier. An

open circuit supplied to the command line will back bias CR1, CR4, or CR7 and forward bias CR2 and CR3, CR5 and CR6, or CR8 and CR9, by-passing the filter. Minus six volts supplied by the IF command circuit of the EMC-25 to WB of the amplifiers causes that particular channel to operate. In order to facilitate receiver tuning in the 0.1 NB position, the EMC-25N is equipped with a dual FINE TUNE control.

An adjustment in each by-pass circuit of the three channels, (R3, R26, R48) allows the insertion loss of this circuit to be adjusted to match the loss of the corresponding quartz crystal filter. The feedback amplifier, consisting of three transistors, Q7, Q8 and Q9, regains the insertion loss through the filter stage and is adjusted to maintain 0 dB loss. Each channel has an individual gain control (R14, R37 and R59).

2.15 DETECTION SYSTEM

The Detection System of the EMC-25 is contained in three individual modules, the Log Detector (A4), Video Detector (A1A1-3), and the Discriminator (A8). The Log Detector and the Discriminator are located in the main shielded compartment and the Video Detector is attached to the bulkhead that separates the control section from the main compartment. The input to the detection system is a linear IF signal from the output of the IF amplifier. The three IF amplifiers have dynamic ranges of approximately 90 dB between noise and the limit levels. Outputs from the detection system include the front panel meter, audio, AM VIDEO, FM VIDEO, and a DC correction voltage to the AFC circuit. Amplitude detection is done in two steps; the Log Detector simultaneously envelope detects the IF signal and provides an output proportional to the log of the peak value of the IF signal, then the Video Detector detects the video signal from the Log Detector output and applies the selected charge and discharge time constants. FM detection is accomplished in the discriminator and the audio signal is recovered in the Video Detector. Refer to Figure 2.2 for a block diagram of the detection system.

2.16 LOG DETECTOR (A4)
Refer to Fig. 6.12 (Page 6-20)

Following each IF Amplifier, a seven-stage sequential detection system is used for a logging detector. The design is unique in its simplicity, in that no delay lines are used. Matched precision components preclude the need for any adjustment of this circuit other than the maximum and minimum scale points. There are two outputs from the circuit. One is a limited IF signal, the other a DC-coupled reproduction of the logged envelope of the signal.

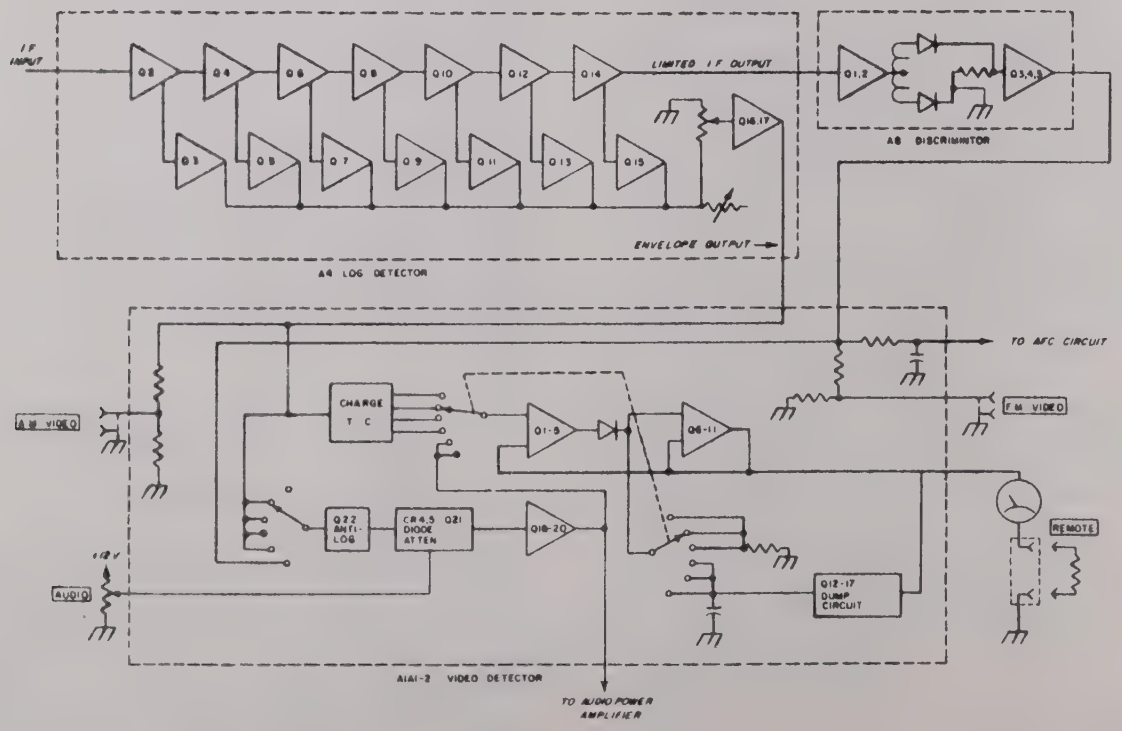


Figure 2.2. Detection System

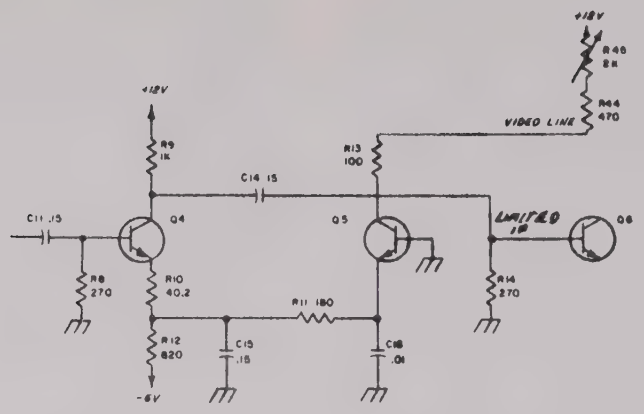


Figure 2.3. Single Stage (Log Detector)

Figure 2.3 illustrates a single stage of the log detector. There are seven similar stages with the IF output of each stage tied in turn to the input of the next stage. The video output of each stage is in parallel with the output of all other stages. The operation of all stages is identical. (Figure 6.12)

Q4 is connected as a grounded emitter amplifier and Q5 is connected as a grounded base amplifier. For small signal levels, Q4 acts as a linear amplifier with the gain approximately determined by the ratio between the emitter resistor (R10) and the collector load which consists of R9, R14 and the input impedance of Q6 has a second-order effect. Under these conditions a fixed current flows in Q5 determined by R10, R11, and R12. Transistors Q4 and Q5 are matched for both H_{FE} and V_{BE} and all transistors within a particular log strip are selected from a particular H_{FE} grouping.

Under large signal conditions Q4 current limits to provide a square wave to the next stage. Simultaneously, detection takes place in the emitter-base junction of Q4 causing C15 to charge to a more positive potential. The combination of R11 and C16 further filters any IF frequency at this point so that a DC potential is presented to the emitter of Q5. At this point Q5 will be cut off, resulting in no collector current flow. Component values are proportioned so that the video stage associated with Q6 will be cut off at approximately the same time as Q4 begins its detection.

As signal level increases, each video stage, commencing with the last one in the strip and proceeding towards the input, will cut off. The collector currents of Q5 and all the other video stages are totaled together in R44 and R45, resulting in a DC voltage, appearing at the point labeled "video line", proportional to the log of the input signal value. The time constants are proportioned so that the signal on the video line will follow the peak value of the instantaneous signal amplitude. Complementary emitter followers, Q16 and Q17, provide a low impedance output to feed the video detector. Q14, the output IF stage in each of the strips, provides a limited IF signal output to the discriminator.

2.17 VIDEO DETECTOR (A1A1-3)
Refer to Fig. 6.14 (Page 6-22)

The Video Detector contains two operational amplifiers. The first operational amplifier is composed of transistors Q1-Q5. The second operational amplifier is composed of transistors Q6-Q11. The first amplifier compares the difference between the input signal received from the Log Detector (base of Q1) and the output signal fed to the meter (base of Q2). Diode CR1 rectifies the output of the first operational amplifier. Switch sections S1A and S1B both apply time constants to the signal. In the SLIDEBACK and PEAK positions, the signal is passed directly to the base of Q1. In the CARRIER position the signal is passed through a 600ms integrator and in the QUASI-PEAK position through a 1ms integrator. At S1B a DC bias is applied in the SLIDEBACK position from the arm of the slideback pot to reverse bias CR1. Any signal peak exceeding this bias value is developed across R35 and fed through SIAR to the audio amplifier. In the CARRIER and QUASI-PEAK positions a 600 ms RC network is connected to insure the proper discharge time for the QUASI-PEAK function and to provide further filtering for the CARRIER position. In the PEAK position, this detector is utilized as a peak detector, with C9 storing the charge. The only discharge path for C9 is through CR1, Q6 and CR2.

The utilization of a long discharge time is necessary for obtaining the true peak value of signals when making amplitude versus frequency

plots with an X-Y plotter. The charge on the detector must be removed after the plotter pen has fully responded or succeeding signals will be masked. A circuit is included in the Video Detector to maintain long discharge time constants only upon receipt of a signal and for a dwell time set by the DWELL control to cause the detector to revert to its short discharge time constant. This circuit is composed of transistors Q12 through Q17, CR2, and associated components. The long discharge time constant occurs when C9 discharges into the reverse impedance of CR1, CR2 and the gate of Q6. The short discharge constant occurs when C9 discharges through R33 to ground potential. With the DWELL control rotated fully counterclockwise, switch S2 is open, resulting in no current flow through Q13. With Q13 turned off, Q16 is also turned off, connecting the series combination of R33, CR3, and R30 between the input and output of the second operational amplifier. As the input and output of this amplifier are at the same potential, there is no current flow through CR2, resulting in the long discharge time constant. When the DWELL control is advanced so that S2 is closed, the circuit is designed to be slightly unbalanced so that Q13 is conducting, causing Q16 to conduct. Current flow through Q17 maintains the emitter of Q16 at approximately -0.7 volts so that when Q16 saturates, its collector is also approximately -0.7 volts. Therefore, the anode of CR2 will be approximately at ground level resulting in C9 discharging through R33 to ground. The rising voltage from the output of the second operational amplifier is coupled to the bases of Q12 and Q15. The presence of C5 in the circuit prevent the base of Q14 from simultaneously rising. Thus, under these conditions, Q15 is cut off and the emitter of Q14 rises in potential slowly as determined by the time constant of C5, R28 and R29. Q13, is also cut off, thereby cutting off Q16 and returning the circuit to the long discharge time constant. When the emitter of Q14 has risen sufficiently, Q13 once again will conduct, and the circuit will revert back to the short time constant discharge. If the signal is still present at this time, it will continue to read properly on the EMC-25 meter and if not present, the detector will be caused to discharge with a time constant of C9 and R33. The dwell between the receipt of the signal and the reversion of the circuit to the short discharge time constant is controlled by both the C5, R28 and R29 time constant and the amount of increase in signal level.

2.18 DISCRIMINATOR (A8)
Refer to Fig. 6.13 (Page 6-21)

Each of the three log detector channels produces a limited output of approximately 1 volt rms. These outputs are fed to the three inputs of the Discriminator, A8. In each channel of the Discriminator, transistors Q1 and Q2 further limit and amplify the signal before applying it to the discriminator transformer. Diodes CR1 and CR2 and the associated components form a conventional Foster-Seely type discriminator. A two section RC filter follows this to further remove IF frequency components from the video signal. Transistors Q3, Q4, and Q5 form an operation amplifier connected for a gain of unity which presents a high impedance to the discriminator and a low impedance to the output. As in the IF amplifier and log detector, the -6 volt supply leads are switched to each of the channels as determined by the RF tuner band selector. Due to the fact that the output signal must swing both positive and negative, diode CR3 is included to completely disconnect those unused channels from the common output line.

2.19 CONTROL SECTION (A1)
Refer to Fig. 6.15 (Page 6-23)

2.19.1 CALIBRATOR (A1A2).
Refer to Fig. 6.25 (Page 6-33)

Amplitude calibration of the EMC-25 is accomplished by means of a built-in impulse generator. In this generator, a mercury wetted reed switch is installed in the center conductor of an open-circuited coaxial line. This line is charged to a voltage determined either by the band in use or an external voltage supplied through the REMOTE connector. It produces an impulse of the DC voltage supplied to it whose width is controlled by the distance between the switch contact and the open end of the coaxial line. Failure can only occur through loss of the charging voltage or breakage of the switch. The result is a reliable and repeatable calibration source. A 6 dB, 50-ohm attenuator is built into the impulse calibrator in order to improve its impedance characteristic and to result in a more uniform output.

The reed switch is driven by a solenoid external to the coaxial structure. The solenoid is driven by a grounded emitter transistor, Q3, which in turn is driven by an asymmetrical multivibrator consisting of Q1, Q2 and associated parts. The repetition rate of this multivibrator is approximately 100 Hz.

An 84 volt neon regulator tube (V1) is included on the Calibrator assembly to provide regulated voltage for the impulse generator contact. When operated on internal power, the impulse generator contact is fed through a voltage divider consisting of R2 located on the Calibrator assembly, resistors located on the Band Selector, A1A5, and pots on the video detector housing. These pots are

of U1 exceeds 1.5 volts, this level coupled to Pin 3 of U2 causes the output of U2 to change instantly from 0 volts to +3 volts. The 3 volt output of U2 coupled to the base of Q7 saturates the transistor causing K1 to be energized, opening the normally closed contacts of K1. These contacts control the pen lift circuitry of the external X-Y recorder. The output of U2 is also coupled through a time-delay circuit R8 and C2 to the input of a Darlington amplifier (Q2 and Q13). With +3 volts at the output of U2, both Q2 and Q13 are saturated. The base to collector of Q13 becomes very low causing all the tuning output voltage of U1 Pin 10 to be developed across R7. The output voltage at Pin 9 of the board will, therefore, drop to zero when the output of U1 exceeds 1.5 volts. Below this threshold Pin 9 of U2 will be 0 volts causing Q2 and Q13 to be cut off, resulting in the full output of U1 appearing at Pin 9 of the board.

A Darlington amplifier consisting of Q14 and Q16 acts as a buffer between the tuning voltage output (Pin 9 of the board) and the X-axis outputs (Pins 12 and 13 of the board). Pin 12 supplies the 0 to 1.5 volt sweep voltage to the external X-Y recorder, while Pin 13 is coupled to the output meter which is calibrated in percent sweep when using the internal sweep generator. Each sweep is initiated by pushing the front panel SWEEP START Switch A1S4. This discharges C6 so that a new charging period is initiated.

To summarize the sweep operation when the SWEEP START switch is momentarily depressed, C6 discharges instantly; then it is charged linearly by current source Q11 and Q12. The sweep voltage present at Pins 9, 12 and 13 is dropped to 0 volts by the action of U2, Q2 and Q13, and the pen lift relay K1 is energized by the action of U2 and Q7. The sweep circuit remains in this state until the SWEEP START switch is once more depressed, initiating the new sweep cycle.

2.21 AUDIO AMPLIFIER (A1P2)
Refer to Fig. 6.16 (Page 6-24)

A logged AM signal from the video detector board is applied to Pin 15 of the board (A1P2). A biased diode network CR2 and CR3 provide an anti-log circuit by attenuating the smaller amplitude signals more, and the higher amplitude signals less, using the log characteristics of the diodes. The anti-logged AM audio signal appears at Pin 13 and is fed to the front panel AM/FM audio switch. The FM audio or AM audio signal is switched to Pin 12 of the audio board by the AM/FM audio switch.

The audio signal is fed to Pin 10 of U2, which is the base of a transistor used as an emitter follower, to match the high input impedance to the low impedance of the audio amplifier.

U1 is a differential amplifier with a cascode input. The audio signal from Pin 1 of U2, is fed to Pin 7 of U1, which is the cascode input. The signal at this input modulates the current through the differential amplifier portion of U1. One differential input, Pin 5 of U1 is grounded.

A zero to +12 volt control voltage from the front panel audio level control is applied to Pin 21 of the audio board. A resistive voltage divider and offset network, consisting of R4 and R6 changes the audio control voltage to approximately -0.5 to +0.5 volts. This control voltage is applied to the second differential input of U1 (Pin 1). The amount of control voltage determines how the audio modulated current will divide between the two transistors of the differential amplifier.

When the audio control is fully clockwise, a control voltage of +0.5 volts is applied to Pin 1 of U1. The entire audio modulated current is directed to Pin 6 of U1, and appears across load resistor R11 as an audio voltage. When the audio control is fully counterclockwise, a control voltage of -0.5 volts is applied to Pin 1 of U1, causing no audio modulated current to be applied to Pin 6 and therefore no audio voltage will appear across load resistor R11. Intermediate settings of the audio control will result in various audio voltages across load resistor R11.

U1 is used as an audio amplifier with variable gain from +20 dB to -40 dB by means of the front panel audio control.

The output of U1, Pin 6, is coupled through C5 to the input of U2 Pin 3, which is used as a power amplifier.

The +9 volt supply is applied to Pins 8 and 9; also through R12 to Pin 11 of U2. Pins 5 and 6 are ground returns for the output transistors and Pin 12 is the return for the preamp transistors in U2. Pin 2 is a differential input and is returned to AC ground through C7. The push-pull output of the power amplifier section of U2, (Pins 4 and 7), is coupled to an audio output transformer, T1. The primary center tap of T1 is connected to the +9 volt supply which provides operating voltage for the output stage of U2. The secondary of T1 is connected to the front panel audio jack from Pins 2 and 3 of the audio board.

The transistor Q1, zener CR5, capacitor C3, and resistors R1, R2, R13 and R14 form a voltage regulator circuit for +9 volt supply to the audio circuits.

adjusted to provide 0db meter readings for calibration.

2.20 SWEEP TUNE (A1P1)

Refer to Fig. 6.17 (Page 6-25)

The sweep tune board card A1P1 is located on a bracket behind the output meter as is the audio circuit A1P2. The functions performed by this board are as follows:

a) An input DC tuning voltage which varies from 0 to +1.5 volts is applied to the input of the board (Pin #3). This tuning voltage may be obtained from various sources having a variety of source impedances. The board contains an operational amplifier with unity gain, and a FET input to present a high impedance to the output, so as not to affect the tuning voltage source. The output of the amplifier appearing at Pin 9 of the board has a low source impedance.

b) Fine tuning is accomplished by making minute DC voltage changes to the output tuning voltage. This may be done either locally or remotely by DC input voltages to Pins 5 and 6, respectively.

c) In the same manner, an AFC error voltage from the FM discriminator locks on an incoming signal by causing small variations in the output tuning voltage.

d) A linear sweep generator on the board generates a 0 to 1.5 volt sweep. The period of this sweep is controlled by the auto sweep circuit A1A7.

In the SWEEP position of the TUNING MODE switch (A1S3), Fig. 6.15, Page 6-23, this sweep voltage tunes the receiver linearly across an entire band. The sweep is initiated by momentarily pressing the front panel SWEEP START switch (A1S4). When the 0 to 1.5 volt sweep is completed, the tuning voltage returns to zero and remains there until the sweep start switch is again pressed.

e) The board generates outputs necessary for the X-axis operation of an X-Y recorder. This includes a buffered tuning voltage output and a relay for penlift operation.

The tuning voltage operational amplifier consists of Q3, a FET differential input stage to provide a high input impedance and U1, an IC differential amplifier to provide the required open loop gain. Q8 and Q9 consist of a temperature compensated current source for Q3. Since the output of U1 (Pin 10) is fed back through a relatively low resistance, (R6-10K ohm) to one gate of the input stage, (Q3) the gain of the amplifier is very close to one. The function of R6 is to make the feedback gate of Q3 a summing point. DC voltage changes at the fine tuning input (Pins 5 and 6 of the board) applied through R10, a 10-megohm resistor, and summed at the Q3 gate will cause minute output voltage changes for vernier tuning. In a similar manner, when the front panel AFC switch is set to ON, the output of the FM discriminator is applied through R15 (330K ohms) and R32 (100 ohms) to the Q3 summing gate to control the output frequency. The resulting tuning output voltage appears at Pin 9 of the board and goes to the tuning regulator board A5P4.

The sweep generator is of the bootstrap type and consists principally of a temperature compensated current source (Q11 and Q12) and a capacitor charging circuit (R23 and C6). When the TUNING MODE switch A1S3 is in SWEEP position, the sweep output (Pin 13 of the board) is connected to the tuning input (Pin 7). Q12 of the current source passes a metered amount of current determined by the operation of the auto sweep circuit. This current develops a voltage across R19 and R22 which will vary by the adjustment of the sweep time control. Since the operational amplifier has a gain of one, the voltage at the tuning input (Pin 7 of the board) and the output of U1, (Pin 10) will be equal. Since C6, the sweep forming capacitor, has the input voltage across it, the voltage across the sweep forming resistor R23 will be equal to the voltage across R19 and R20 and will be constant for a given SWEEP TIME setting. As the current through R23 is constant, the change in voltage across C6 will be constant, and the generated sweep voltage will be linear. R19 and R27 are screwdriver adjustments used to calibrate the sweep times. R19 changes the charging voltage for C6. It is used for setting the long (60 minutes) sweep time. Since this will also have an equal effect on the shorter sweep times, R19 is adjusted first when calibrating time. R27 also varies the charging voltage for C6 by changing the conduction of current source (Q2). R27 will have a large effect on the fast sweep time (one minute) as the SWEEP TIME control in series with it is approximately 0 ohms. At slow speed, however, when the SWEEP TIME control is approximately 10K ohms, R27 will have little effect. R27 is therefore used to adjust the fast SWEEP TIME.

U2 is a differential switch whose output (Pin 9) will be approximately 0 volts when Pin 3 input is less positive than Pin 4 input. The output will be approximately 3 volts when Pin 3 is more positive than Pin 4. Pin 4 is biased with a DC voltage adjusted by R13, and this bias is set at 1.5 volts. Thus, when the sweep voltage at the output

of U1 exceeds 1.5 volts, this level coupled to Pin 3 of U2 causes the output of U2 to change instantly from 0 volts to +3 volts. The 3 volt output of U2 coupled to the base of Q7 saturates the transistor causing K1 to be energized, opening the normally closed contacts of K1. These contacts control the pen lift circuitry of the external X-Y recorder. The output of U2 is also coupled through a time-delay circuit R8 and C2 to the input of a Darlington amplifier (Q2 and Q13). With +3 volts at the output of U2, both Q2 and Q13 are saturated. The base to collector of Q13 becomes very low causing all the tuning output voltage of U1 Pin 10 to be developed across R7. The output voltage at Pin 9 of the board will, therefore, drop to zero when the output of U1 exceeds 1.5 volts. Below this threshold Pin 9 of U2 will be 0 volts causing Q2 and Q13 to be cut off, resulting in the full output of U1 appearing at Pin 9 of the board.

A Darlington amplifier consisting of Q14 and Q16 acts as a buffer between the tuning voltage output (Pin 9 of the board) and the X-axis outputs (Pins 12 and 13 of the board). Pin 12 supplies the 0 to 1.5 volt sweep voltage to the external X-Y recorder, while Pin 13 is coupled to the output meter which is calibrated in percent sweep when using the internal sweep generator. Each sweep is initiated by pushing the front panel SWEEP START Switch A1S4. This discharges C6 so that a new charging period is initiated.

To summarize the sweep operation when the SWEEP START switch is momentarily depressed, C6 discharges instantly; then it is charged linearly by current source Q11 and Q12. The sweep voltage present at Pins 9, 12 and 13 is dropped to 0 volts by the action of U2, Q2 and Q13, and the pen lift relay K1 is energized by the action of U2 and Q7. The sweep circuit remains in this state until the SWEEP START switch is once more depressed, initiating the new sweep cycle.

2.20.1 Auto Scan Circuit A1A7 Refer to Fig. 6.17-B (Page 6-26-B)

Normally, a slow sweep rate is required when making X-Y recordings in the carrier or quasi-peak detector modes, since the detector rise times are relatively long. The purpose of the auto-scan circuit is to allow a fast sweep rate, slowing the sweep only when the presence of a narrowband signal is detected.

Refering to Schematic Diagram Fig. 6.17-B, the FM Video signal from the Video Detector enters at terminal E1 and passes through a high/low/pass filter consisting of C1, R4, C2, R5, and C3. The average rate of change signal at the output of the filter feeds an inverting operational amplifier (U1) having a gain of approximately 60DB. A positive-going signal at the input of U1 (Pin 2) results in a negative output (Pin 6). Both Q1 and Q2 in the output of U1 are normally saturated with no input to U1. A negative output of U1 causes both Q1 and Q2 to be cut off. Q2 and R17 are connected in parallel with the front panel "Auto Sweep" control (R-18). Since this circuit (Q2, R17, R18) is in series with the emitter of the current source (A1P1Q12) on the sweep circuit board A1P1, the effective resistance of the circuit determines the sweep speed. With Q2 saturated, the 470 ohms of R17 shunts the relatively high resistance of the auto-sweep control (100k) resulting in a fast sweep rate. An input signal to the auto-sweep results in Q2 being cut off so that the setting of Auto-sweep potentiometer R18 controls the sweep speed.

2.21 AUDIO AMPLIFIER (A1P2) Refer to Fig. 6.16 (Page 6-24)

A logged AM signal from the video detector board is applied to Pin 15 of the board (A1P2). A biased diode network CR2 and CR3 provide an anti log circuit by attenuating the smaller amplitude signals more, and the higher amplitude signals less, using the log characteristics of the diodes. The anti logged AM audio signal appears at Pin 13 and is fed to the front panel AM/FM audio switch. The FM audio or AM audio signal is switched to Pin 12 of the audio board by the AM/FM audio switch.

The audio signal is fed to Pin 10 of U2, which is the base of a transistor used as an emitter follower, to match the high input impedance to the low impedance of the audio amplifier.

U1 is a differential amplifier with a cascode input. The audio signal from Pin 1 of U2 is fed to Pin 7 of U1, which is the cascode input. The signal at this input modulates the current through the differential amplifier portion of U1. One differential input, Pin 5 of U1 is grounded.

A zero to +12 volt control voltage from the front panel audio level control is applied to Pin 21 of the audio board. A resistive voltage divider and offset network, consisting of R4 and R6 changes the audio control voltage to approximately -0.5 to +0.5 volts. This control voltage is applied to the second differential input of U1 (Pin 1). The amount of control voltage determines how the audio modulated current will divide between the two transistors of the differential amplifier.

When the audio control is fully clockwise, a control voltage of +0.5 volts is applied to Pin 1 of U1. The entire audio modulated current is directed to Pin 6 of U1, and appears across load resistor R11 as an audio voltage. When the audio control is fully counterclockwise, a control voltage of -0.5 volts is applied to Pin 1 of U1, causing no audio modulated current to be applied to Pin 6 and therefore no audio voltage will appear across load resistor R11. Intermediate settings of the audio control will result in various audio voltages across load resistor R11.

U1 is used as an audio amplifier with variable gain from +20 dB to -40 dB by means of the front panel audio control.

The output of U1, Pin 6, is coupled through C5 to the input of U2 Pin 3, which is used as a power amplifier.

The +9 volt supply is applied to Pins 8 and 9; also through R12 to Pin 11 of U2. Pins 5 and 6 are ground returns for the output transistors and Pin 12 is the return for the preamp transistors in U2. Pin 2 is a differential input and is returned to AC ground through C7. The push-pull output of the power amplifier section of U2, (Pins 4 and 7), is coupled to an audio output transformer, T1. The primary center tap of T1 is connected to the +9 volt supply which provides operating voltage for the output stage of U2. The secondary of T1 is connected to the front panel audio jack from Pins 2 and 3 of the audio board.

The transistor Q1, zener CR5, capacitor C3, and resistors R1, R2, R13 and R14 form a voltage regulator circuit for +9 volt supply to the audio circuits.

2.22 Band-Switching: Bandswitching is accomplished by means of a reversable motor driving the receiver turret mechanism. The motor drive circuitry determines the direction of rotation and the motor start and stop functions are controlled by the motor control (A9A1) and Motor Drive (A9A2) P.C. Boards.

2.22.1 Forward Motor Control: Refer to Schematic Diagram 6.21

A momentary positive signal from either the local band step switch or from a remote source enters A9A1 at terminal E4. Passing through Blocking diode CR1 and limiting resistor R3, the pulse turns Q2 on. Q2 and Q4 form a bistable emitter coupled multivibrator circuit. A positive pulse turning on Q2 turns off emitter coupled Q9. The resultant positive Q9 collector voltage coupled back to the base of Q2 latches Q2 on. If Q2 receives a negative pulse, cutting it off, Q9 again conducts, its collector goes low keeping Q2 cut off. Conduction of Q2 saturates Q1 and Q3. Q1 is a "motor on" signal used to inhibit rotary solenoid operation in the remote antennas when the motor is going by alterning the antenna band code. Q3 drives the motor drive transistor Q10 on A6P2. With Q10 saturated the battery raw voltage (+20 and -12 volts) is simultaneously placed across the motor clutch and the motor through reversing relay K1. Diode CR8 buffers the inductive kick of both motor and clutch. A micro-switch S1, mechanically linked to the detent mechanism of the turret is connected between -12V and E5 of A9A1. S1 is normally closed when the turret is detented, but opens when the turret is turning between bands. S1 closes as the turret detents in the next band and the -12V coupled through capacitor C2 to the input of Q2 causes this bistable multivibrator to be changed in state, removing the drive to the motor and clutch, as long as there is a positive input at E4, it overpowers the action of S1 and the motor continues to turn. When the positive input is removed the motor is stopped at the next detent position of the turret.

2.22.2 Reverse Motor Circuit.

The motor drive circuit for reverse operation is the same as for forward operation of the turret as positive input signal at terminal E7 is coupled through CR4 to the input of the motor control circuit. This positive voltage is also coupled through R10 and R11 to the base of Q7, saturating it. This saturates the reverse relay driver Q9 causing Relay K1 to energize. With K1 energized, the polarity of voltage to the armature of the permanent magnet is reversed, causing reverse rotation of the motor. Q11 is a motor on sensing transistor an A6P2 which is saturated whenever the motor is drawing current. This motor on signal, and the motor reverse signal derived from the collector of Q9 are sent to an "and" circuit consisting of Q5 and Q6. This "and" circuit latches the reverse relay whenever both "motor on" and "motor reverse" signals are present, preventing external signals from reversing the motor while it is running, but allowing the reverse relay to be unlatched when the motor stops. Transistor Q5 is also saturated by the"motor on" signal from Q11. This transistor shorts the "motor reverse" signal to ground, preventing an external input from reversing the motor while it is running in the forward direction.

2.23 EMC-25 N OPTION (A-10) Refer to Fig. 6.22 (Page 6-30) and Fig. 6.23 (Page 6-31)

The following information relates to receivers incorporating the N Option. (EMC-25N).

The Circuit Changes are as follows:

An RF Amplifier (Module A2A3), has been added to the RF tuner and hard wired to the contacts on the Stator-board.

Normal operation is unchanged except that an ultra narrow bandwidth is added and may be operated simply by changing the BANDWIDTH switch on the front panel to the 0.1 NB position.

Because of the extremely narrow bandwidths of the 0.1 NB position on the BANDWIDTH selector, a dual FINE TUNE control is used on the EMC-25N. The grey knob, the normal FINE TUNE, is used with WB and NB positions and the inner black knob, a vernier, is used in conjunction with the FINE TUNE for the ultra narrow bandwidth.

With the BANDWIDTH switch in the 0.1 NB position the approximate 3 dB bandwidths of the EMC-25N are as follows:

Bands 1-7 (10 kHz – 2.4MHz) is 50 Hz

Bands 8-10 (2.4MHz –30 MHz) is 500 Hz

Bands 11-15 (20MHz – 1 GHz) is 5 kHz

Operating the EMC-25N in the 0.1 NB mode improves CW tangential sensitivities by approximately 10 dB as compared to the NB mode.

2.24 L/O OPTION (A2A3) Refer to Fig. 6.28 (Page 6-36)

The Model EMC-25L Receiver may incorporate an LO option, which outputs the LO Frequency of all bands to the receiver rear panel.

This Option allows the operator to connect a frequency counter to the LO Output connector (rear Panel), for the purpose of reading the LO frequency directly on the counter. Refer to *Table 2.3 (Example Frequencies)*.

Example: LO Frequency = I.F. Frequency + Received Freq.

TABLE 2.3

BAND	LO Frequency = Received Frequency + IF Frequency
1, 2, 5, 6, 7,	(2.175MHz) = (2.0 MHz) + 175 KHz
3, 4, 8, 9, 10,	(7.6 MHz) = (6.0 MHz) + 1600 KHz (1.6 MHz)
11, 12	(48.7 MHz) = (40 MHz) + 8700 KHz (8.7 MHz)
13	(188.7 MHz) = (150 MHz) + 38.7 MHz
14	(548.7 MHz) = (480 MHz) + 68.7 MHz
15	(698.7 MHz) = (600 MHz) + 98.7 MHz

SECTION III

OPERATING INSTRUCTIONS

3.1 GENERAL

This section provides instructions for operation of the Interference Analyzer, Model EMC-25 in all modes. Instructions are also included for pre-operating calibrations, accessory operation and reading interpretation.

CAUTION

Read all information in this Section before attempting operation.

Improper operation may cause costly damage to the instrument.

3.2 OPERATIONAL PRECAUTIONS

3.2.1 LOCAL/REMOTE Switch must be in local position for manual operation.

3.2.2 INPUT VOLTAGE. Damage to the input attenuator may result if signals larger than 5 volts rms are applied continuously. Pulse signals must be less than 0.5 watt average power and 500 watts peak power.

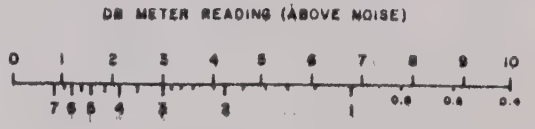
3.2.3 OFF FREQUENCY SIGNALS. Any superhet receiver such as the EMC-25 may generate spurious signals when one or more high-level signals are applied to its input. The exact amplitude of the resultant signal is dependent on so many variables that specific prediction is not feasible.

Despite the many design precautions taken to minimize such responses, they will appear under some conditions. One method of determining whether a signal is spurious or not is to increase the input attenuation by 20 dB and note which signals drop by that amount. Any signals decreasing by more or less than 20 dB are spurious. The SPD-125 Spectrum Analyzer accessory is a useful aid in this regard.

3.2.4 AUDIO OUTPUT. Use of low-impedance earphones or of a resistance load of less than 600 ohms will result in poor frequency response, distortion, and low power output.

3.2.5 TUNING ACCURACY. Stated tuning accuracy is met with the FINE TUNE control at mid-rotation. The FINE TUNE control is intended only for tuning narrow-band signals in the high frequency range and to compensate for discriminator offset when using AFC.

3.2.6 AMPLITUDE ACCURACY. For signals close to the noise level of the instrument, a correction must be made. Use the Correction Factor Scale below.



Top Scale is that increase in dB in meter reading over noise level when input signal is applied.

Bottom Scale is that amount in dB to be subtracted from total meter reading to find actual signal level.

EXAMPLE:

Internal Noise	-30 dB (above 1uV)
Meter indication with signal applied	-25 dB
Increase in meter reading (30-25)	5 dB
From Scale: amount to be subtracted	1.65 dB

Actual signal level equals:

(-25) - 1.65 = 26.65 dB (above 1 uV)

The EMC-25 cannot be satisfactorily calibrated when the AFC is in operation. Carriers can be measured with AFC on, only if the signal has been peaked on the meter using the FINE TUNE control.

3.3 PRE-OPERATIONAL CALIBRATIONS

All measurements made with the EMC-25 are based on its calibration as a two-terminal voltmeter. The built-in calibration standard is an impulse generator whose spectrum is essentially flat between 10 kHz and 1 GHz.

Calibration factors are also provided for making broadband measurements. Figure 3.1 is a typical calibration chart. Figure 3.2 illustrates front panel controls for calibration.

NOTE

Proper operation of the impulse generator, utilized as the built-in calibration standard, requires that the EMC-25 be physically situated within 30° of horizontal. Also, when operating normally, a moderate amount of "bounce" in the meter reading of the calibration is to be expected.

Band Number	Frequency Range	Broadband Conversion Factor*	
1	10.0kHz–35.0kHz		
2	35.0kHz–75.0kHz		
3	70.0kHz–150kHz		
4	120kHz–250kHz		
5	250kHz–500kHz		
6	0.5MHz–1.1MHz		
7	1.1MHz–2.4MHz		
8	2.4MHz–5.5MHz		
9	5.5MHz–12.5MHz		
10	12.5MHz–30MHz		
11	20MHz–45MHz		
12	45MHz–100MHz		
13	100MHz–200MHz		
14	200MHz–500MHz		
15	500MHz–1000MHz		

*Add to meter DB reading and attenuator reading to obtain broadband signal level (DB/uv/MHz).

Figure 3.1 Typical Calibration Chart-Broadband

3.3.1 CW CALIBRATION. To calibrate the EMC-25 for directly reading signal levels in microvolts or dB above one microvolt proceed as follows:

a. Set controls:

FREQUENCY	— As required
TUNING MODE	— Manual
AFC	-OFF
Local/Remote	-Local

b. Depress the SHUNT CAL button and simultaneously rotate the CAL knob until the meter indicates zero.

c. The instrument is now calibrated. dB above one microvolt may now be read by algebraically adding the dB value shown on the meter to that indicated at the ATTENUATOR setting. The black values are used below 30MHz (Bands 1-10), and the orange above 20MHz (Bands 11-15).

For the bands covering up to 30MHz (white frequency scale), microvolt values may be read directly from the meter when the attenuator is in the 0 dB position. Full scale various attenuator position (orange or black) are as follows:

ATTENUATOR	FULL SCALE VOLTAGE
0 (black only)	10 uV
20	100 uV
40	1 mV
60	10 mV
80	100 mV
100	1 V

d. Set the DETECTOR FUNCTION switch and ATTENUATOR as required by the signal being measured. The BANDWIDTH switch may be set to either Wide or Narrow, as required by the signal bandwidth or noise considerations.

3.3.2 BROADBAND CALIBRATION. To calibrate the EMC-25 for reading signal levels in dB above one microvolt per megahertz, proceed as follows:

a. Set controls:

FREQUENCY	— As required
TUNING MODE	— Manual
AFC	-OFF
Local/Remote	-Local

b. Depress the SHUNT CAL button and simultaneously rotate the CAL knob until the meter indicates zero. (See note in paragraph 3.3.)

c. The instrument's gain is now set properly. To read signals in terms of dB above-one-microvolt-per-megahertz, algebraically add the dB values on the chart in Fig. 3.1. Page 3-2 to the meter reading and those indicated around the ATTENUATOR. The black values are to be used below 30MHz (bands 1-10) and the orange above 20MHz (bands 11-15).

3.4 ACCESSORY CONNECTIONS

a. Connect antenna control cable (ACC-25B) from MS (round) connector on rear of EMC-25 to antenna (RVR, RVA, or ALR).

b. Connect EXY-125 Plotter to 11 pin connector on rear.

3.5 CONTROL FUNCTIONS

3.5.1 ATTENUATOR AND REMOTE POSITION. The attenuator adds attenuation to the RF and IF circuits in 20 dB increments. The black numbers are added to the meter reading to obtain the proper scale multiplier below 30 MHz. The orange backed numbers are used above 20MHz. The REMOTE position would be used only when an external attenuator is used, in lieu of the internal.

3.5.2 TUNING. The main manual frequency control for the instrument causes the cursor of the frequency dial to move and indicate the frequency to which the instrument is tuned.

3.5.3 FINE TUNING. A vernier control covering approximately one percent of a band is used to facilitate tuning of narrowband signals and is especially useful on the higher bands.

3.5.4 TUNING MODE. A two-position selector switch which determines whether frequency tuning is to be done manually or swept automatically.

3.5.5 SWEEP START. Resets the internal circuit to the low end of the band selected when the tuning mode switch is in sweep position. Upon its release the receiver sweeps upward in frequency linearly with time, at a predetermined speed which is set by the sweep time control. It also controls the plotter pen lift.

3.5.6 CAL. Activates the impulse generator calibrator and disconnects the receiver input.

3.5.7 BAND STEP. Actuates internal step motor to move up or down to band desired.

3.5.8 AFC SWITCH. This switch activates the automatic frequency control when a desired frequency has been located.

3.5.9 AM/FM AUDIO SWITCH. This switch detects the desired audio signal.

3.5.10. DWELL. Adjusts the length of time the detector holds a signal level when the Detector Function switch is in the PEAK mode. Extreme counterclockwise rotation provides maximum "dwell." (See Section 3.5.18.5 PEAK). Turn the DWELL control slightly CW until switch S2 just clicks. This is the maximum "dwell" time for the dump. The fully clockwise position allows the detector to hold the applied signal for only 50 μs. (approx.) This is the "dwell full on" position. Intermediate positions of the dwell control change the hold time of the detector proportionately.

3.5.11 THRESHOLD. Adjusts the aural extinction point when the Detector Function switch is in the "slideback" mode.

3.5.12 AUDIO. Adjusts the audio output level at the phone jack.

3.5.13 BAT TEST. When pressed, the lower scale on the front panel meter indicates the optional battery condition

3.5.14 BANDWIDTH. Switches the receiver to either the Wide or Narrow bandwidth with respective values specified for the frequency band selected.

3.5.15 CAL. Adjusts the receiver gain to permit amplitude calibration. This control has a lock feature.

3.5.16 POWER SWITCH. Used to place the instrument in operation.

3.5.17 SWEEPTIME. Adjusts the internal sweep time from one minute to 60 minutes., with det. in peak position.Used in conjunction with Tune Mode and Sweep Start Switch. Adjusts time spent on signal when det. in CARR or Quasi.

3.5.18 DETECTOR FUNCTION SWITCH

3.5.18.1 GENERAL. Careful use of the DETECTOR FUNCTION switch, BANDWIDTH switch and associated controls can yield much information about the type of signal being received. Some functions are useful only for manual use, while others can be used both manually and automatically.

3.5.18.2 SLIDEBACK POSITION. Having performed the Broadband Calibration (para. 3.3.2), very weak signals or adjacent signals having different repetition rates may be measured aurally using the slideback function.

a. Calibrate according to para. 3.3.2.
b. Turn the ATTENUATOR to obtain a reading "on scale."
c. Plug in PHONES. Turn AUDIO CW. Turn THRESHOLD CW.
d. Adjust AUDIO so that background hiss can barely be heard.
e. Adjust THRESHOLD until peaks of the signal being measured are heard, then turn CW slowly until they just become inaudible.
f. Read meter and add factors as in paragraph 3.3.2.

Alternately, if an external variable broadband signal source is available, it can be substituted for the unknown signal to determine its amplitude.

3.5.18.3 CARRIER POSITION. In the CARRIER position, the meter indicates the rms value of the carrier with all modulation stripped off by the meter's time constant. When using this position, it should be remembered that high peak signal levels might overload the EMC-25 and result in erroneous readings. If the DETECTOR FUNCTION switch is first placed in PEAK and the ATTENUATOR adjusted so that full scale meter deflection is not exceeded, the CARRIER function can then be used with assurance that overload will not occur.

3.5.18.4 QUASI-PEAK. In the Quasi-PEAK position, the metering circuitry provides a one millisecond charge time constant and a 600 millisecond discharge time constant over the entire meter scale. Since the EMC-25 accomplishes this detection subsequent to logarithmic envelope detection, the result does not conform to CISPR, ANSI and VDE, which require strict linearity and bandpass characteristics. However, the optional CMM-25 adapts the EMC-25 to meet these requirements.

3.5.18.5 PEAK. The PEAK measurement circuit has a rise time much shorter than the reciprocal of the IF amplifier bandwidth. Fall time is greater than 10 seconds with the DWELL control fully counterclockwise (the normal position for manual operation). The PEAK circuit is calibrated in terms of the rms value of an unmodulated carrier for unmodulated signals. Pulsed RF signals will be read as the rms value of the carrier at the peak of the modulation. There are no significant low repetition rate errors until the rate is below one pulse per second. Pulse response is also altered by the IF bandwidth and its near-gaussian characteristic.

3.5.19 AFC OPERATION. Accurate CARRIER measurements of drifting signals can be made if the AFC circuit is used. To properly use the AFC:

a. Set controls:

DETECTOR FUNCTION – CARR

BANDWIDTH – As desired

TUNING MODE – Man

b. Using the TUNING and FINE TUNING controls, tune the signal for maximum meter indication.

c. Turn the TUNING MODE switch to AFC and repeak the signal with the FINE TUNE control.

3.5.20 BANDWIDTH CONTROL. A variation of at least 6:1 in 3 dB bandwidth is selectable with the BANDWIDTH control. The available bandwidths, which vary with the band in use, are shown in Section 1.6.5.

Maximum CW sensitivity is obtained in the NARROW bandwidth, but if it is desired to recover the signal's modulation, the bandwidth should be chosen carefully, consistent with the width of modulation.

Maximum impulse sensitivity is obtained in the WIDE bandwidth, for which all calibration curves are given. Determination of whether a signal is broadband or narrowband can be made by setting the Detector Function switch to Peak, the Bandwidth to WIDE and tuning in the signal. Note the meter indication and switch to NARROW. Compare the drop in meter indication with that noted when switching from WIDE to NARROW, using the internal impulse generator (see paragraph Broadband CAL (a) for control settings). If the drop on the external signal is less than that using the impulse generator, by a margin of at least 2 dB, the signal is narrow compared to the wide bandwidth of the EMC-25 and cannot be accurately measured in terms of dB/uV/kHz (or MHz).

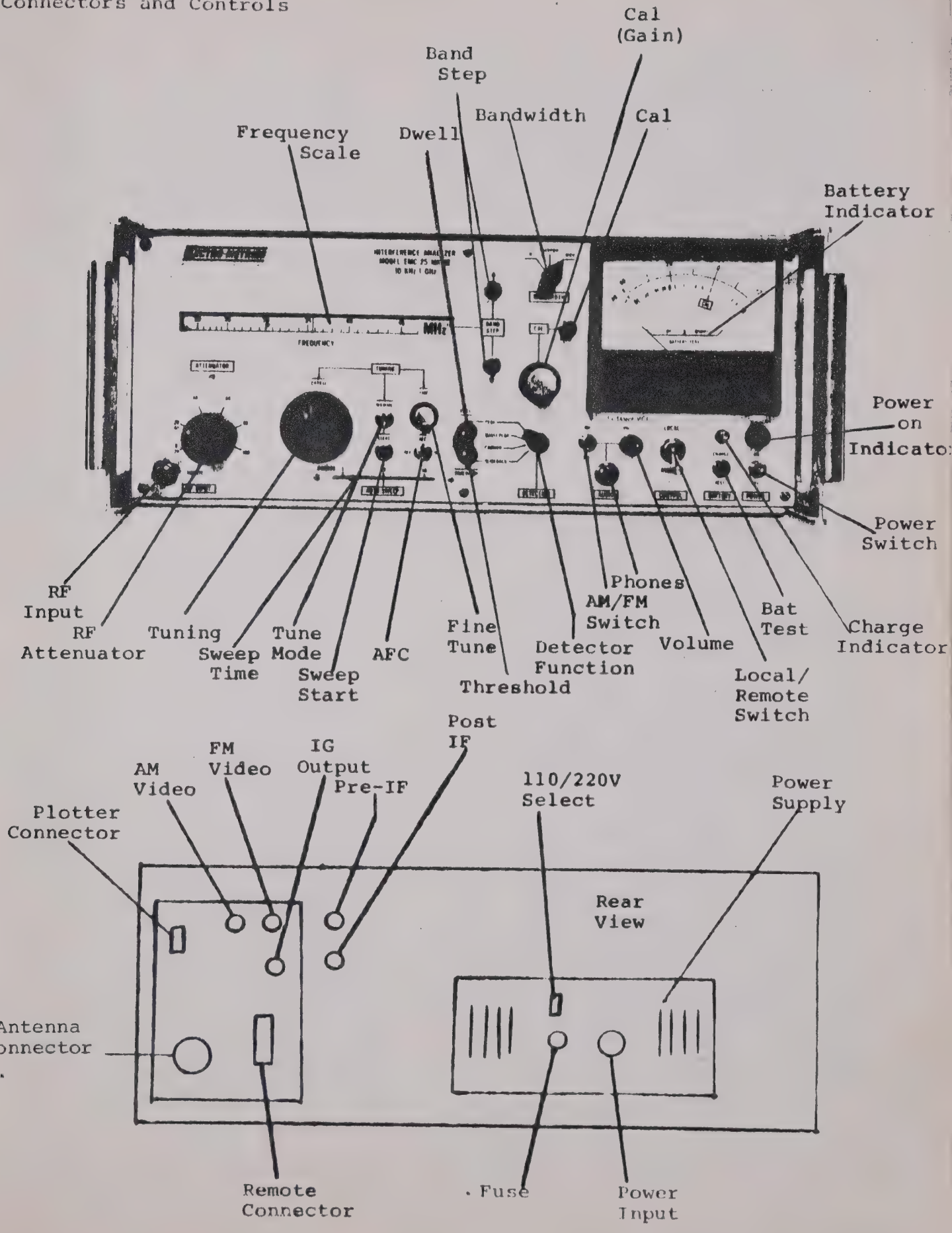
3.5.21 BATTERY INDICATOR. The front panel meter indicates the condition of the internal nickel-cadmium battery, when BAT test button is pressed.

3.5.22 CHARGE INDICATOR. With AC Power applied to rear of instrument, and instrument off this indicator will illuminate. Indicator will be extinguished when instrument is on.

3.5.23 POWER ON INDICATOR. Illuminates when instrument is on, extinguished when instrument is off.

3.5.24 LOCAL/REMOTE SWITCH. When in local position, total control of the instrument will be at the front panel. Remote would be used when options such as ESC-125 Programmer, SPD-125 Spectrum display, or computer control is desirable. These options connect to rear panel remote connector.

Figure 3.2
Front and Rear Panel
Connectors and Controls



3.6 FRONT PANEL CONNECTORS

3.6.1 RF INPUT. The nominal 50-ohm input terminal to which the signal is to be measured in applied.

3.6.2 PHONES. The terminal for 600-ohm or higher impedance earphones.

3.7 CONNECTION FUNCTIONS-REAR PANEL

3.7.1 IG OUTPUT. The output terminal of the I.G. is used in conjunction with optional CLC-252, Calibrator level control unit.

3.7.2 AM VIDEO. A nominal 91-ohm output that is proportional to the logarithm of amplitude of the input signal.

3.7.3 FM VIDEO. A nominal 91-ohm output that is proportional to the instantaneous frequency of the input signal.

3.7.4 REMOTE CONNECTOR (50 pin). This connector provides for remotely controlling the EMC-25 functions such as bandswitching, attenuation, gain, etc.

3.7.5 PLOTTER CONNECTOR (11-Pin). This connector is used to connect an external plotter to the receiver for a permanent record copy when the receiver is not in a system. i.e. used independently.

3.7.6 ANTENNA CONNECTOR (MS ROUND). This connector is used to connect the ALR, RVA, or RVR remote antenna.

3.7.7 PRE-IF OUTPUT. Provides a linear signal at one of the three IF frequencies depending upon the band in use. Impedance is nominally 50-ohms. Voltage level and bandwidth depend on the band in use. This output should be capped when unused, and terminated in 50-ohms during use.

3.7.8 POST-IF OUTPUT. Provides a linear signal at one of three IF frequencies and selected bandwidth as determined by the band in use and position of the BANDWIDTH switch. The output is approximately 3 mV for bands 1 through 8, and 1 mV for bands 9 through 15. This output should be capped when unused and terminated in 50-ohms when in use.

3.7.9 POWER INPUT. AC power or external DC may be connected here to operate unit or charge internal optional battery.

3.8 POWER SUPPLY

3.8.1 GENERAL. To permit field operation and to reduce the possibility of ground loops in laboratory work, a nickel-cadmium battery is used for the primary power supply. The battery additionally serves the useful purpose of a pre-regulator for AC line operation. In the battery charger compartment is located a constant current supply for charging the battery and a high voltage converter. High impedance of those power lines entering the main circuit section facilitates a high degree of filtering. The low voltage series-regulated power supply and the tuning voltage regulator follow conventional practice.

3.8.2 POWER REQUIREMENTS. Unless otherwise specified on the purchase order, the EMC-25 is normally wired for operation with the following power supplies.

a. External 105 to 120 volt AC, at 50 to 450Hz.
b. External 30 to 56 volt DC.

3.8.3 110/220 Select.

A switch on the battery charger compartment cover changes power supply to operate from 105 to 130 volts AC or 210 to 260 volts.

3.8.4 Fuse - 3 amp, 3AG, slo blo.

3.8.5 BATTERY OPERATION (Optional)

To operate the EMC-25 on internal battery, turn on the POWER switch. Press battery test and if meter reads in operate range, instrument may be put into use. It is advisable to check the battery condition periodically during extended use.

A fully charged batter will operate the EMC-25 for at least eight hours. Use of the band-stepping motor in the EMC-25 will shorten the operating cycle moderately; the exact amount depending on the duty cycle of its use. The instrument should not be stored with a discharged battery longer than one week. During long storage periods, the battery should be brought to full charge at least once every three months.

3.8.6 BATTERY POWER SUPPLY

The battery pack (BAT-25) supplied with the instrument incorporates 24, 4A.H., 1.5V nickel-cadmium cells.

The battery can be used for 8 hours of sustained operation without charging. It will fully recharge after such usage in 12 to 16 hours. To recharge the battery, connect the instrument to an external AC source. Battery charging is automatically controlled by the instrument and will occur with the POWER switch OFF only.

Because testing with this instrument is usually performed sporadically for periods of time, it is difficult to know the charge condition of the battery. The front panel meter indicates the approximate battery condiction, when bat. test button is pressed.

To charge the battery, set the line voltage switch on the rear panel to the appropriate position, and connect the line cord PCD-25. The front charge light will glow, indicating that the charger is operating. The POWER switch must be OFF to obtain charge.

3.8.7 CHARGING THE BATTERY

Battery life is a function of many factors in addition to the charge/discharge ratio. However, maximum life will be obrained from the EMC-25 if the following principles are observed:

a. Operation of the EMC-25 when it is connected to AC power produces no discharge of the battery and avoids the need for re-charging to replenish loss.

b. As long as the interval between periods of use does not exceed one week, any loss of charge resulting from battery-only operation for a period (T) can be replenished by recharging with the unit off the same length of time, (T).

c. When the EMC-25 is being used only infrequently its battery can be kept in optimum and charged condition between use by connecting the EMC-25 to AC, with the front-panel power switch "off", for a total of 6 to 8 hours each week.

3.8.8 BATTERY PROTECTION CIRCUITS

3.8.8.1 OVERCHARGING

Overcharging will not be possible, because the charger circuit automatically reduces charging current as soon as overcharging reaches a significant level.

3.8.8.2 EXCESSIVE DISCHARGE

Excessive Discharge will not be possible, because the flow of battery current to all circuits is automatically interrupted, as soon as battery voltage drops to a value indicating negligible

remaining capacity.

3.8.8.3 LINE OPERATION

To operate the instrument from an AC line, adjust the line voltage before connecting the PCD-25 line cord. Then turn the POWER switch on and check the battery condition (if internal battery option is installed) by pressing the BAT TEST button and noting if the meter reads in the "operate" region.

3.8.8.4 EXTERNAL BATTERY

Battery operation for periods longer than 8 hours may be accomplished by using external storage batteries in conjunction with power cord PDD-25. To operate, connect an external floating battery of 45 to 56 volts utilizing the PDD-25. The red clip should be connected to the positive battery terminal. Turn on the POWER switch and check the battery indicator (front panel). The instrment will only draw power from the external battery (as indicated by the charge lights) if the external battery is more than 6.5 volts higher than the internal battery.

CAUTION

Do not ground the battery terminals or establish a reference ground. Let the external supply "float" above ground. The internal battery must be left in the instrument and connected when the instrument is being operated from external AC or DC supply to provide proper capacity.

3.8.8.5 POWER INPUT. (External Battery)

Either AC power or an external battery may be connected here to charge the optional internal battery.

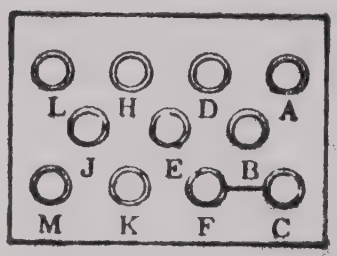
3.9 REMOTE OPERATION.

3.9.1 PROGRAMMING

Remote programming of the EMC-25 is achieved through the REMOTE connector by either voltage or resistance control. Figure 3.5 illustrates the REMOTE connector with the letter corresponding to each input and the legend denotes each pin function.

3.9.2 X-Y PLOTTING

3.9.2.1 GENERAL. With the addition of an X-Y Plotter, such as Electro-Metrics Model EXY-125B, the internal sweep circuit can be used to make semi-automatic measurements. (Figure 3.4)



A Pen Comm (-)
B X Out (+X)
C Shield Gnd
D Pen Lift Coil (N/O) (+
E X Comm (Gnd) (-)
F Y Comm (Gnd) (-)
K Event Logic
M "Y" Out (+Y)

Figure 3.4 Recorder Connector (J9) Front View)

3.9.2.2 Internal Sweep (Peak Detector Position).

When the detector switch is in the "Peak" position the "Auto Sweep" circuit is inhibited. When the "sweep start" switch is pressed, a frequency sweep is generated whose rate (1 min. to 60 min.) is controlled by the front panel sweep-rate control.

3.9.2.3 Auto Sweep: When the Detector is in any position other than "peak", the auto-sweep circuit is activated. The basic "no-carrier" sweep rate is approximately 20 seconds per band regardless of the setting

of the auto-sweep rate control. When the presence of a carrier signal is detected by the auto-sweep circuitry, the sweep rate is slowed depending on the setting of the auto-sweep rate control.

Calibration is accomplished as follows:

a. Leaving the Tuning Mode selector in MANUAL, tune the EMC-25 to the low frequency end of any band.
b. Adjust the plotter X-ZERO to bring the Pen to the left-hand margin of the paper.
c. Tune to the high frequency end of the band and adjust the X-GAIN control of the plotter to the right-hand margin of the paper.
d. Repeat steps a.) thru c.) as required.
e. Adjust the plotter Y-ZERO until the noise reads slightly above the bottom margin.
f. Supply an impulse signal to the input of the EMC-25 from an external impulse generator, or place DET to slideback and adjust threshold for full scale.
g. Adjust the IG level to make the EMC-25 meter read full scale.
h. Adjust the plotter Y-gain control to bring the pen to the top margin.
i. Place the Tuning Mode selector in the SWEEP position; set the SWEEP time control to desired position. Depress and release the START button. The EMC-25 will sweep across the chosen band. The noise level and various IG levels may be plotted on the paper to provide calibration lines. If it is decided to recheck a signal after automatically scanning, the Tuning Mode switch should be moved back to MAN.

3.9.3 EXTERNAL CONTROL. Through use of the outputs provided at the REMOTE 50-pin connector on the front panel of the EMC-25, many functions may be remotely programmed. Connections of many of the front panel controls to the controlled circuits must be made through the rear panel REMOTE connector.

Outputs from the receiver include X and Y outputs for X-Y plotting, binary switch closure indication of band in use, and sufficient power to operate a number of external accessories.

The EMC-25 has a built-in provision for remotely changing frequency bands. Components used are a DC gear-motor, an electro-mechanical clutch, a microswitch and a printed circuit board containing circuitry to actuate bandswitching.

3.10 ACCESSORIES

3.10.1 GENERAL. A wide range of programming, pickup, and convenience accessories are available for the EMC-25. Programming accessories are those which utilize the inherent capability of the EMC-25 for remote control to provide an automated capability. Pick-up devices extend the EMC-25 capability from a two-terminal tunable voltmeter to a field and current measuring device. Convenience accessories extend the utility of the instrument by providing audible outputs, convenient junction points and remote meter indication, etc.

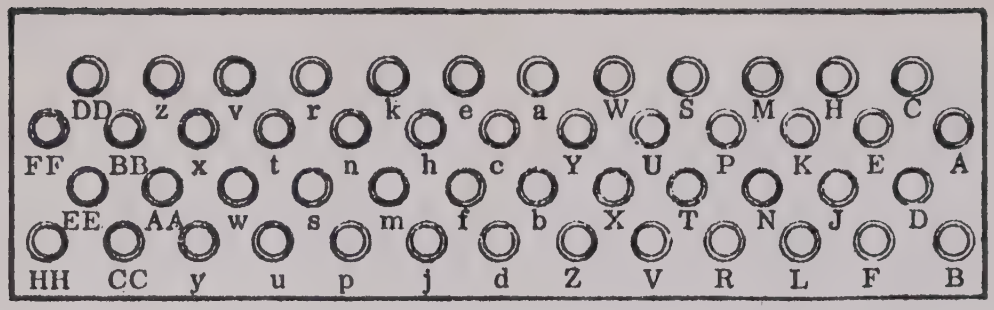


Figure 3.5 Remote Connector J5 (Front View)

A Tuning Pot Arm (Manual)
B Spare
C Tuning Voltage Input (0 to +1.5V nom.)
D .1NB Comm.
E Fine Tune
F Spare
H Spare
J Tune GND
K Analog GND
L Spare
M X-Y Plot Pen Lift +
N Pen Lift Command -
P Gain Control IN
R IG Drive Command -6V
S Bandwidth Command
T Dwell Command
U Bandwidth Select (+12V=NB' (-6V=WB)
V +12 Volts
W 0.1 NB Select
X -6 Volts DC (Regulated)
Y Band Step ↓
Z Digital GND
a Peak Comm.
b + Y Out
c + X Out

d Spare
e Band Step ↑
f Spare
h Band Logic Command
j 80 dB Attenuator
k 0-1 Band Logic
m Spare
n 0-2 Band Logic
p 40 dB Attenuator
r 0-4 Band Logic
s 20 dB Attenuator
t 0-8 Band Logic
u Spare
v Spare
w Remote 0 dB Attenuator
x IG Contacts (-300V to +300V for ext.level)
y Gain Out
z IG Level Out
AA Gnd.
BB Shunt Cal Command -12VDC Activate
CC -7 to -15VDC Raw
DD Audio Gnd.
EE HV Raw 110V (Min) 200V (Max)
FF Audio Out
HH +15 to +24VDC Raw

ANTENNA CONTROL CONNECTOR

A GND
B 1-Logic
C 2-Logic
D 4-Logic
E 8-Logic
H -12VDC
I +20VDC

3.10.2 PROGRAMMING ACCESSORIES. The model ESC-125A Programmer utilizes the sweep, bandswitching, and X and Y output capability of the EMC-25 to provide completely automatic amplitude vs. frequency X-Y plotting of the spectrum from 10 kHZ to 1 GHz. The rapid sweep capability of the EMC-25 is utilized by the SPD-125 Spectrum Display Module. The CRT of this accessory can display an entire EMC-25 octave band at one time, a band sector, or provide an amplitude vs. time display of modulation on a selected carrier.

3.11 PICK—UP DEVICES. The three low frequency antennas are powered by the EMC-25 and switch bands remotely according to the binary circuit indication of the band in use of the EMC-25. Covering the 10 kHz — 30 MHz range, the active vertical antenna, Model RVA-25 electronically converts the extremely high impedance of the rod antenna to the low impedance input of the EMC-25 through use of an amplifying network that provides a high sensitivity to the field monitored. Antennas, Model RVR-25 and ALR-25 contain only passive matching networks. All three antennas switch matching networks automatically as the EMC-25 bands are switched.

The BDA-25, Broadband Dipole Antenna is utilized across the 20-200 MHz frequency range. This antenna employs the use of 3 fixed-tuned dipole arms. From 50 MHz — 100 MHz, one set of extensions should be used; from 20 — 50 MHz, both sets of extensions should be used. The antenna may be used across the entire range 20 — 200 MHz without extensions, if some sensitivity loss at the lower frequencies is permissible. The BIA-25, Bi-Chonical Antenna, without adjustment, satisfies Mil Std 461/462 for 20 — 200 MHz.

The 200 MHz — 1 GHz frequency range is covered by the LCA-25, Log Conical Antenna. This antenna is a broadband device that is circularly polarized and is designed for RFI/EMC specification testing and general use.

3.12 CONVENIENCE ACCESSORIES

For obtaining an audible output from the EMC-25, two types of 600 ohm head phones are available. The EEF-25 are provided for standard voice frequencies and the EHF-25 permit high fidelity reception. When aligning antennas and performing similar tasks, the Remote Indicating Meter, Model RIM-252 is a useful accessory. The CJB-252 Connector Junction Box, using a 50-pin connector is furnished when needed to permit the simultaneous use of remote antennas and programming accessories.

SECTION IV

PERFORMANCE CHECK–OUT

4.1 GENERAL

The Performance Tests listed in this section are designed to give specific information as to the operational status of the instrument. The results of these tests will indicate whether the EMC-25 is performing within specification limits or not, and whether repair or recalibration is necessary. The results of these tests as an incoming inspection check should be recorded and used as a standard for further testing at every maintenance level.

When testing for VOLTAGE ACCURACY, FREQUENCY ACCURACY, CW SENSITIVITY, IMPULSE SENSITIVITY and IMAGE REJECTION, refer to three test frequencies per band. These tests shall be performed at the first and last indicated frequencies and at a frequency in the center of each of the 15 bands.

Table 4-1 lists recommended test equipment, required characteristics and when equipment is used.

4.2 WHEN TO TEST

The performance tests should be used:

a. As a part of the incoming inspection check with the results permanently recorded.

b. Periodically, as a part of the maintenance check for every 2,000 hours of use.

c. As a part of the repair procedure to locate malfunctioning circuits.

TABLE 4-1. Recommended Test Equipment

INSTRUMENT TYPE	REQUIRED CHARACTERISTICS	USE
Signal Generators HP-651 HP-608 HP-612	10 kHz – 1000 MHz Calibrated Attenuator .1uV to 1.0V output 10kHz to 25 MHz .1uV to 0.1V output 25 MHz to 1 GHz Amplitude Accuracy ± 1 dB Frequency Accuracy (checked with Frequency Counter below) 50 ohms source impedance	Performance check-out Alignment Calibration
Impulse Generator EMD CIG-25	Calibrated 0 to +90 dB uV/MHz	Calibration Performance check-out
Step Attenuator H/P 355D	Calibrated 0-120dB Accuracy ± 0.1 dB Referred to 0 dB Position	Performance check-out Calibration Alignment
Frequency Counter HP-5246 HP-5253 HP-5254	Calibrated 10 kHz – 1 GHz Accuracy ± 0.1%	Performance check-out Alignment Calibration
Digital Volt-Ohmmeter	3½ Digits 1.5V to 1500V f.s. ±0.1% + 1 Digit Accuracy	Alignment Repair
Video Voltmeter HP-400E	Average or RMS responding 10 MHz Frequency Response 10MV to 10V f.s. ± 2% Accuracy 1M ohm input impedance	Alignment Repair
Oscilloscope Tektronix-453	50MV to 10V f.s. DC coupled 10MHz Frequency Response 1 sec to 0.1 u sec/CM time base	Alignment Repair

4.3 PERFORMANCE TESTING PROCEDURE

a. Unless otherwise specified in the test, the front panel controls shall be set as follows:

ATTENUATOR	40 dB Black)
TUNING MODE	MAN
FINE TUNING	Mechanical Center
LOCAL/REMOTE	Local
DETECTOR FUNCTION	Carr
AUDIO	Fully CCW
BANDWIDTH	WB
POWER	ON

b. The following tests may be performed in any sequence desired. However, it is recommended that they be performed in the order in which they are listed. To minimize time spent in band switching, tuning, etc. as many readings as possible should be taken while set to any given frequency.

4.4 ACCURACY AND PERFORMANCE

4.4.1 PRECAUTIONS

a. When making measurements such as the Voltage Accuracy Test, caution should be taken to avoid ground loops between AC operated equipment.

b. The proper source impedance must be presented to the instrument's input. Some Impulse Generators will work properly only if a pad is placed at their output.

c. Interconnecting cables should be of the shortest length possible or of known loss.

d. A 15 minute warm-up period for the EMC-25 should be allowed before beginning the tests.

e. The EMC-25 must be within 30° of the horizontal position and right side up whenever its internal impulse generator is used.

f. A check of the BAT test indicator on the front panel should be made to see if it reads in operate area before proceeding to test.

g. Some Impulse Generators are calibrated in terms of equivalent peak CW voltage while the majority are in terms of equivalent rms voltage. It should be noted that a 3 dB difference exists between the two types, and 3 dB must be subtracted from a peak voltage calibrated instrument's indicated output, to obtain the equivalent rms value. The EMC-25 is calibrated in terms of the equivalent rms value of the peak signal for impulse signals.

h. Accuracy of the test equipment must be commensurate with that of the parameter being measured.

4.4.2 CW VOLTAGE ACCURACY

a. Depress and hold in the CAL pushbutton switch. Rotate the CAL control to produce a front panel meter reading of zero for the band and frequency undergoing test. Release the CAL pushbutton.

b. Using a signal source with a 50-ohm output impedance tuned to the EMC-25 selected frequency, apply a signal to the RF INPUT jack of the proper amplitude, 100 uV for 10kHz to 30 MHz and 1 mV for 30MHz to 1 GHz. Record the difference between the actual meter reading and the proper reading of 0 dB.

c. Repeat steps a) and b) at 3 test frequencies on each band, 1-15. Voltage accuracy is ± 1.5 dB in the top 20 dB of the meter scale at all frequencies.

4.4.3 BROADBAND VOLTAGE ACCURACY

a. Depress and hold in the CAL pushbutton switch. Rotate the CAL control to produce a front panel meter reading of zero for the band and frequency undergoing test. Release the CAL pushbutton.

b. Using a calibrated Impulse Generator, apply a signal to the RF INPUT jack of the proper amplitude, 80 dBuV/MHz for bands 1-7 and 60 dBuV/MHz for bands 8-15.

c. Add the meter reading obtained to the factor given for the frequency under test on Broadband conversion Chart and attenuator setting to obtain broadband level.

4.4.4 FREQUENCY ACCURACY

a. With the BANDWIDTH switch in the NB position, the DETECTOR FUNCTION switch in the CARR position and the CAL control set at approximately mechanical center, adjust the main TUNING knob on the EMC-25 so that the cursor is exactly on each of the 3 test frequencies per band, being careful to view the scale straight-on to eliminate parallax.

b. Adjust the frequency of the signal source to the vicinity of the test frequency and set its level for a meter reading of approximately "0" dB.

c. Carefully adjust the frequency of the signal source for a peak indication on the EMC-25 front panel meter. Frequency accuracy specification is ± 2% of the indicated frequency (with the FINE TUNE control at its mechanical center).

d. Perform steps a) through c) for 3 test frequencies on each band 1-15.

4.4.5 ATTENUATOR ACCURACY

a. With the ATTENUATOR in the 40 dB (black) position, the DETECTOR FUNCTION switch in the CARR position, and the TUNING set to the approximate center of band 6, apply a 100μV CW signal. Adjust the signal generator for a peak indication on the meter and adjust the CAL control for 0 dB on the meter.

b. Change the signal source attenuator in 20 dB steps while changing the EMC-25 ATTENUATOR accordingly. Record the difference between the actual meter readings and the 0 dB mark. Specification for ATTENUATOR accuracy is ±1 dB.

c. Repeat steps a) and b) on Band 8 and on Band 11, changing the input level to 1 mV on Band 11.

4.4.6 CW SENSITIVITY

a. With the ATTENUATOR in the "0" dB position, BANDWIDTH switch in the NARROW position and the DETECTOR FUNCTION switch in the CARR position, apply a 10 μV signal for the 3 test frequencies on bands 1-10 and adjust the CAL control for a full scale meter indication.

b. Disconnect the generator, terminate the EMC-25 RF INPUT with a 50-ohm load, and read the residual noise indicated on the meter. Since residual noise equals tangential sensitivity, record this reading. Sensitivity specifications may be obtained from Section I.

c. Apply a 100 uV signal and adjust the "CAL" control for a full scale meter indication for the 3 test frequencies on bands 11-15.

d. Disconnect the generator and record the sensitivity as discussed in step b).

4.4.7 IMPULSE SENSITIVITY

a. With the ATTENUATOR in the 0 dB position, bandwidth to wide, detector function to peak, apply an impulse signal to the RF INPUT, increasing the level until the meter reads 3 dB above the residual noise.

b. The level applied by the generator is the impulse sensitivity. Sensitivity specifications may be obtained from Section I.

c. Follow this procedure at the three test frequencies for all bands 1-15.

4.4.8 BANDWIDTH

a. With the DETECTOR FUNCTION in the CARR position, attenuator to 40 dB black, tune the EMC-25 to a mid range frequency on band 6 and adjust the CAL control for "0" dB on the meter with 100 uV input from a signal generator.

b. Increase the signal generator output by 3 dB on the EMC-25 meter and increase the frequency of the generator until the meter reads "0" dB. Note and record the frequency of the generator.

c. With the same output level as in step b), decrease the frequency of the generator until the meter again reads "0" dB. Note and record the frequency of the generator. The difference between the two recorded frequencies is the 3 dB IF wideband bandwidth at that frequency. Bandwidth specification may be obtained from Section I.

d. Repeat the steps a) through c) for Band 8 at a frequency in the center of the band.

e. Increase the generator output to 1 mV and repeat the procedure on band 11 at a frequency in the center of the band.

f. Change the BANDWIDTH switch to the NB position and repeat steps a) through e).

g. Change the BANDWIDTH switch to 0.1 NB position (if the EMC-25 has the N OPTION included) and repeat steps a) through e).

4.4.9 METER TRACKING AND DYNAMIC RANGE

a. With the ATTENUATOR selector in the 40 dB (black) position, the DETECTOR FUNCTION switch in the CARR position, the BANDWIDTH switch in the NB position and at a frequency in the center of Band 6 apply a 100 uV CW signal from a signal generator. Adjust the signal generator for a peak indication on the EMC-25 meter and adjust the CAL control for 0 dB on the meter.

b. Decrease the original signal to the EMC-25 by 20 dB and note that the meter reading has dropped to -20 dB, within a ±2 dB specification.

c. Increase the original signal to the EMC-25 by 20 dB and note the meter reads full scale ±1.5 dB.

d. Repeat the above procedure at a frequency in the center of band 8.

e. Increase the generator output to 1 mV and repeat steps a) through c) at a frequency in the center of band 11.

4.4.10 IMAGE REJECTION

a. With the ATTENUATOR in the 40 dB (black) position, the BANDWIDTH switch in the NB position, and the DETECTOR FUNCTION switch in the CARR position, apply a CW signal level of 1 mV at each of the three test frequencies on each band, 1-10, and tune the generator for a peak indication on the meter.

b. Adjust the CAL control for a full scale indication on the meter.

c. Tune the generator to twice the IF frequency plus the EMC-25 indicated frequency.

Example: Band 1, 14 kHz

2 (175 kHz) + (14 kHz) = 364 kHz = Image Frequency

d. Increase the generator output by 30 dB and tune the generator for a peak indication on the EMC-25 meter.

e. Record the difference between full scale and the meter reading from step d), adding 30 dB; this is the Image Rejection. Specification for Image Rejection is 45 dB minimum.

f. Repeat steps a) through e) for bands 11-15, except increase the signal output to 10 mV for a full scale indication at three test frequencies for each band. See Table 2-3 for first and second IF frequencies for each band.

4.4.11 IF REJECTION

a. With the ATTEN selection in the 40 dB (black) position, the BANDWIDTH switch in the NB position, and the DETECTOR FUNCTION switch in the CARR position, inject a signal level of 1 mV at a frequency in the center of each band, 1-10 and tune the generator for a peak indication on the EMC-25 meter.

b. Adjust the CAL control for a full scale deflection on the meter.

c. Tune the generator to the first IF frequency and increase the generator output by 30 dB.

d. Tune the frequency of the signal generator for maximum meter deflection.

e. Record the difference between full scale and the meter reading from step d, adding 30 dB; this is IF Rejection. Specification for IF Rejection is 45 dB minimum.

f. Repeat the steps a) through e) for bands 11-15 except increase the signal output at the frequencies for bands 11-15 to 10 mV for full scale indication.

g. Repeat steps a) through e) for the second IF frequencies of bands 3, 4, 13, 14, 15 and record the data.

4.4.12 SPURIOUS RESPONSE

a. Place the ATTENUATOR switch in the 0 dB position, the DETECTOR FUNCTION switch to the CARR position, and the BANDWIDTH to NB position. Terminate the RF input with 50 ohms.

b. With all input signals disconnected, slowly tune the EMC-25 through each entire band covering and recording the frequency of any on-scale responses.

SECTION V

MAINTENANCE AND REPAIR

5.1 GENERAL

This section provides the information necessary for maintenance, repair and calibration of the Interference Analyzer EMC-25. Repair of as complex an instrument as the EMC-25, should only be attempted by qualified technicians who are thoroughly acquainted with EMC equipment and measurement techniques. It is recommended that this entire section be read before attempting any of the procedures presented herein.

5.2 MAINTENANCE

To maintain the EMC-25 it is recommended that a check be made after 2000 hours of normal use. This check should consist of performing the tests in Section IV, with the results compared against the specification limits, to determine if the instrument is operating properly.

CW calibration **MUST** be performed first.

5.3. CALIBRATION PROCEDURE

The EMC-25 must be upright and within ±30° of horizontal or the impulse calibrator will not operate properly. If the instrument has been vertical or upside down for a long period, it is advisable to shake it while in the horizontal position before calibrating. This insures repeatability of the impulse generator.

a. CW CALIBRATION

1. Set the front panel controls as follows:

Local/Remote	Local
TUNING MODE	MAN
DETECTOR FUNCTION	CARR
BANDWIDTH	WIDE

2. Tune the EMC-25 to the lowest frequency indicated on the calibration curve for the band being calibrated. Apply an unmodulated CW signal level of 100 uV for 10 KHz – 25 MHz or 1 MV for 25 MHz – 1000 MHz to the RF INPUT, tune the generator for a peak indication on the front panel meter, and adjust the CAL control to obtain a meter indication of 0 dB.

3. Depress the CAL button and read the meter. Meter should read zero ±2DB.

b. IMPULSE CALIBRATION

1. Following the CW calibration of each band, leave the DETECTOR FUNCTION switch in the PEAK position and select a frequency.

2. Depress the CAL button and adjust the CAL control until the meter reads zero.

3. Connect an impulse generator to the RF INPUT connector. Set DWELL to CCW. For Bands 1-7 set the IG level to 80 dB uV/MHz at the frequency selected and read the meter. Convert the meter reading to the Broadband factor by using Figure 5.1.

4. For Bands 8-10 set the IG level to 60 dB uV/MHz at the frequency selected and read the meter. Convert the meter reading to the Broadband factor.

5. For Bands 11-15 set the IG level to 60 dB uV/MHz at the frequency selected and read the meter. Convert the meter reading to the Broadband factor.

6. Write the Broadband number on chart provided on Fig. 3-1.

5.4 REPAIR

Repair should take place when one of the following conditions exists:

a) There is an obvious fault in operation.

b) Operation is outside the specification limits and cannot be restored by recalibrating the EMC-25.

5.4.1 REPAIR PROCEDURES

5.4.1.1 METHOD

1. Use of the Repair Sequence Guide, Figure 5.2 to determine the proper order of repair. (Refer to Figure 5.3)

2. Replace the defective module if that is the desired level of service.

3. Repair the defective module using signal tracing and voltage measurement techniques in conjunction with the information given in Sections III and IV.

4. Align and calibrate the EMC-25 after repair has taken place per Figure 5.2.

5.4.1.2 MODULE REPLACEMENT

1. All assemblies, modules and printed circuit boards are replaceable without affecting the overall characteristics and specification limits of the EMC-25, *providing* alignment and calibration is performed after replacement in the sequence given in Figure 5.2.

2. Many modules may be removed by loosening quarter-turn fasteners while others require removing their retaining screws.

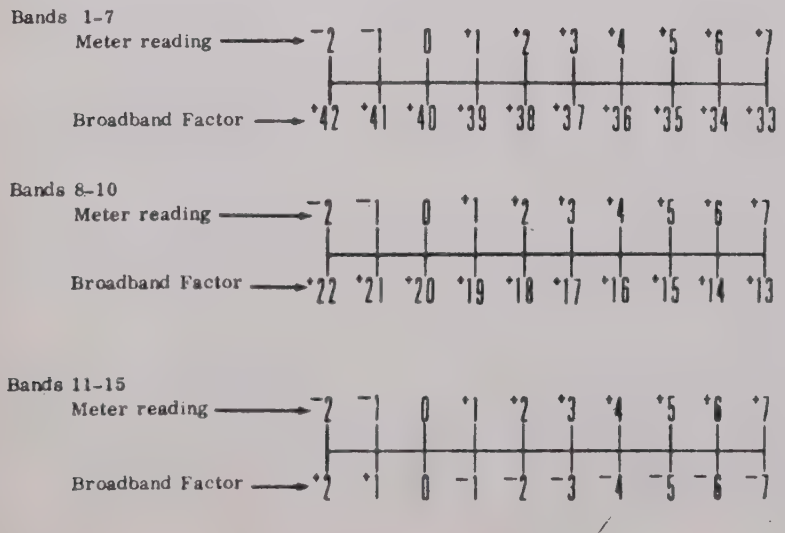

Bands 1-7
Meter reading
−2 −1 0 +1 +2 +3 +4 +5 +6 +7
Broadband Factor
+42 +41 +40 +39 +38 +37 +36 +35 +34 +33
Bands 8-10
Meter reading
−2 −1 0 +1 +2 +3 +4 +5 +6 +7
Broadband Factor
+22 +21 +20 +19 +18 +17 +16 +15 +14 +13
Bands 11-15
Meter reading
−2 −1 0 +1 +2 +3 +4 +5 +6 +7
Broadband Factor
+2 +1 0 −1 −2 −3 −4 −5 −6 −7

Figure 5.1. Broadband Factors

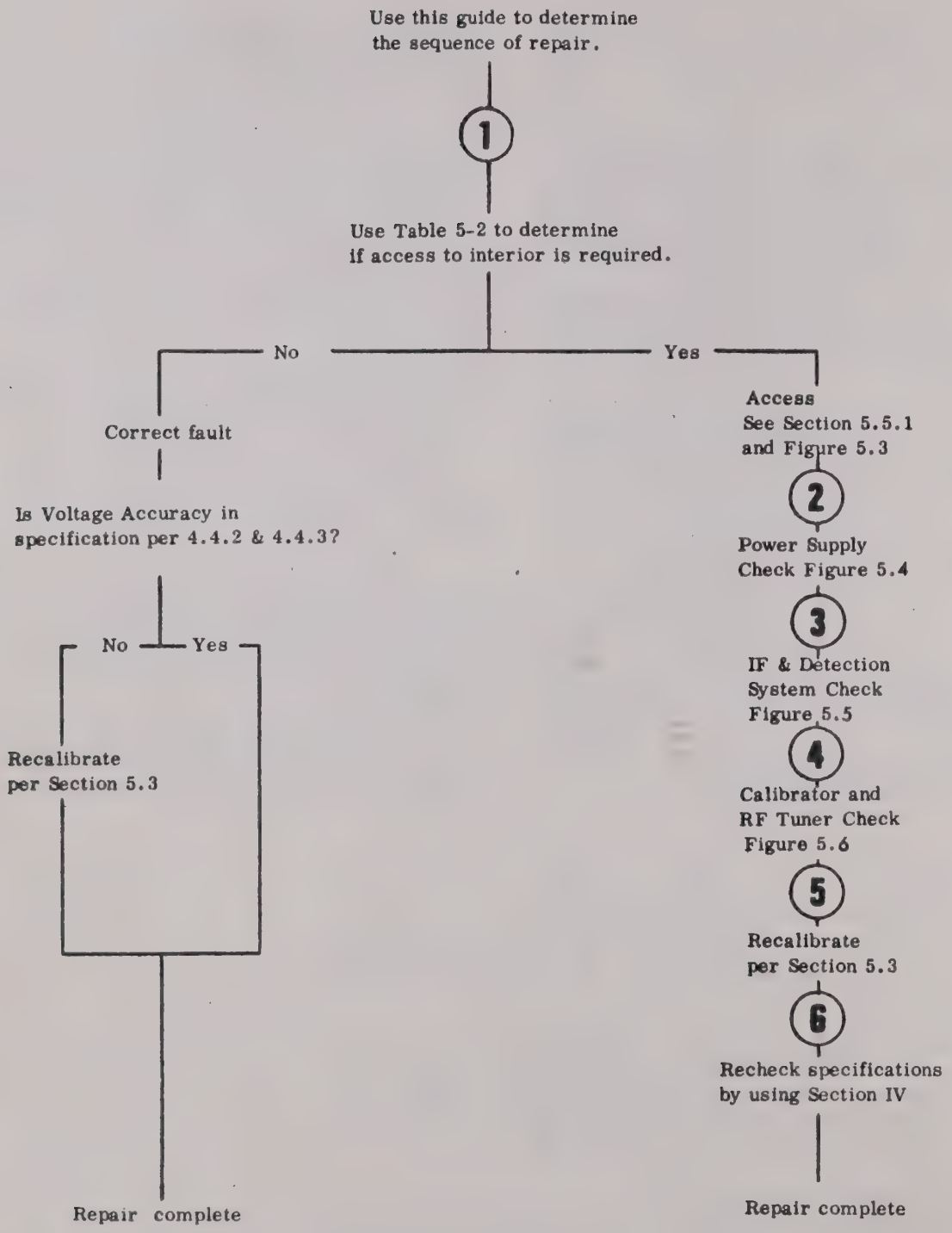


Figure 5.2. Repair Sequence Guide

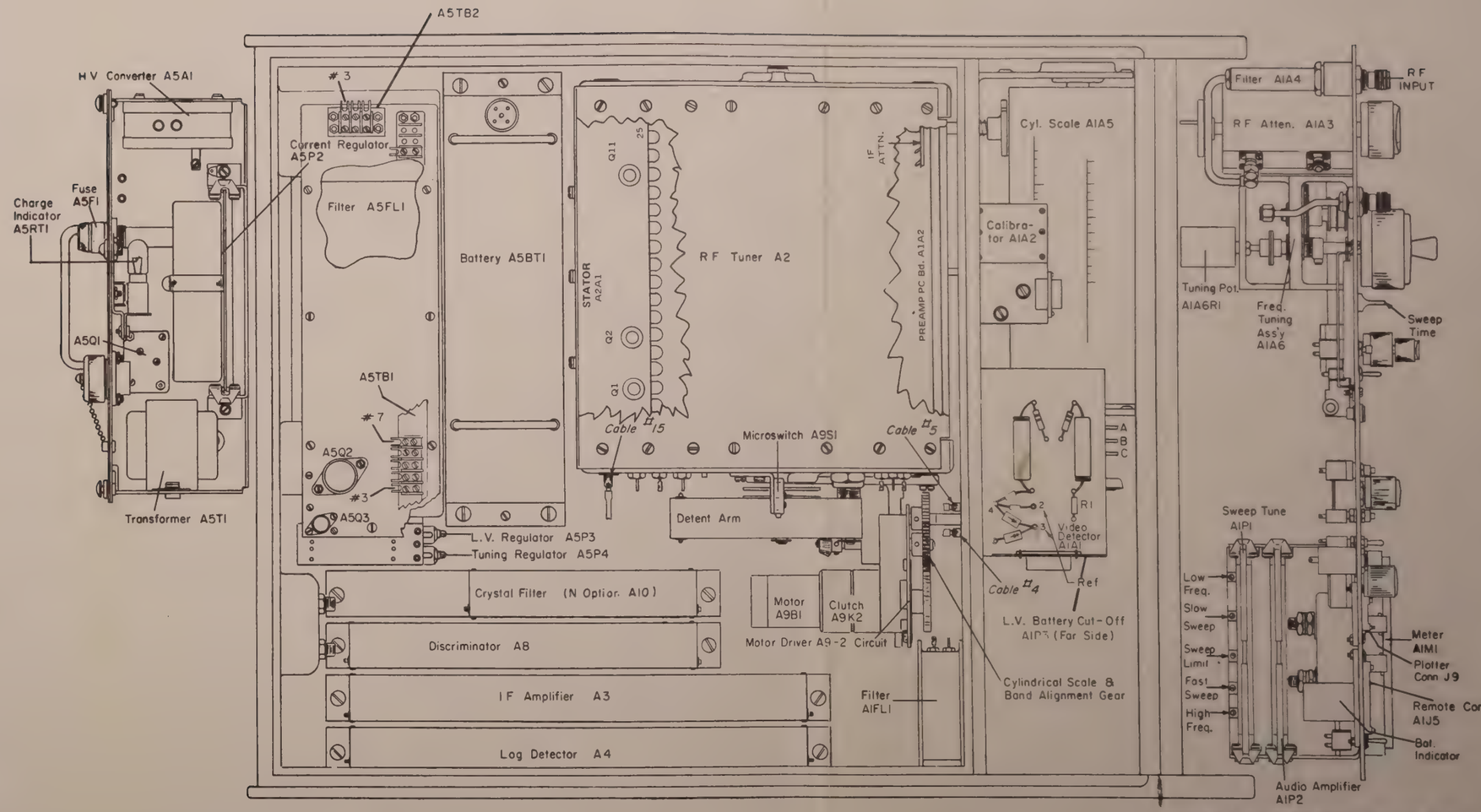


Figure 5-3 LOCATION GUIDE (BOTTOM VIEW)

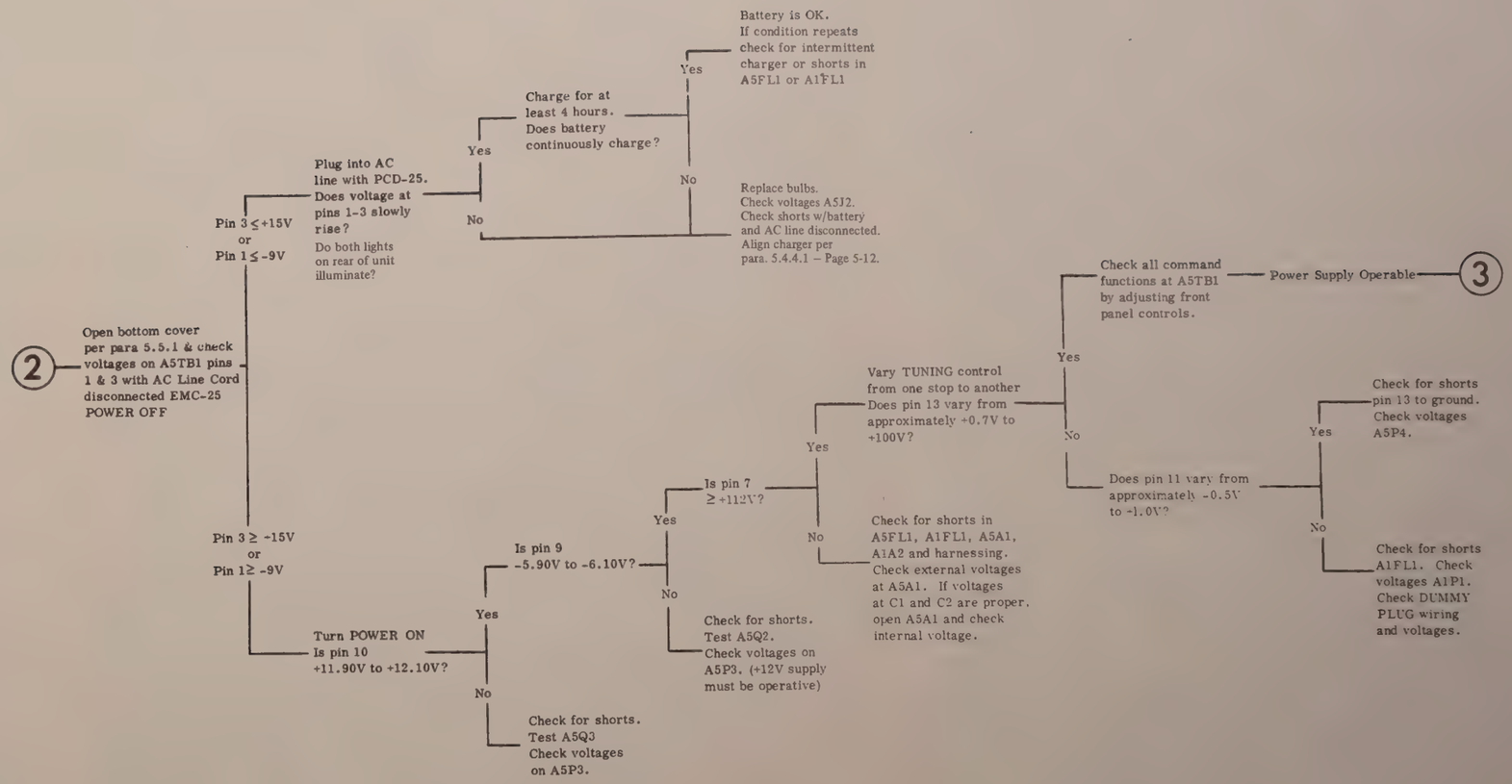

2
Open bottom cover per para 5.5.1 & check voltages on A5TB1 pins 1 & 3 with AC Line Cord disconnected EMC-25 POWER OFF
Pin 3 ≤ +15V or Pin 1 ≤ -9V
Plug into AC line with PCD-25. Does voltage at pins 1-3 slowly rise?
Do both lights on rear of unit illuminate?
Yes
Charge for at least 4 hours. Does battery continuously charge?
Yes
Battery is OK. If condition repeats check for intermittent charger or shorts in A5FL1 or A1FL1
No
Replace bulbs. Check voltages A5J2. Check shorts w/battery and AC line disconnected. Align charger per para. 5.4.4.1 – Page 5-12.
No
Pin 3 ≥ -15V or Pin 1 ≥ -9V
Turn POWER ON Is pin 10 +11.90V to +12.10V?
Yes
Is pin 9 -5.90V to -6.10V?
Yes
Is pin 7 ≥ +11.2V?
Yes
Vary TUNING control from one stop to another Does pin 13 vary from approximately +0.7V to +100V?
Yes
Check all command functions at A5TB1 by adjusting front panel controls.
Power Supply Operable
3
No
Does pin 11 vary from approximately -0.5V to -1.0V?
Yes
Check for shorts pin 13 to ground. Check voltages A5P4.
No
Check for shorts A1FL1. Check voltages A1P1. Check DUMMY PLUG wiring and voltages.
No
Check for shorts in A5FL1, A1FL1, A5A1, A1A2 and harnessing. Check external voltages at A5A1. If voltages at C1 and C2 are proper, open A5A1 and check internal voltage.
No
Check for shorts. Test A5Q2. Check voltages on A5P3. (+12V supply must be operative)
No
Check for shorts. Test A5Q3 Check voltages on A5P3.

Figure 5.4. Power Supply Checking

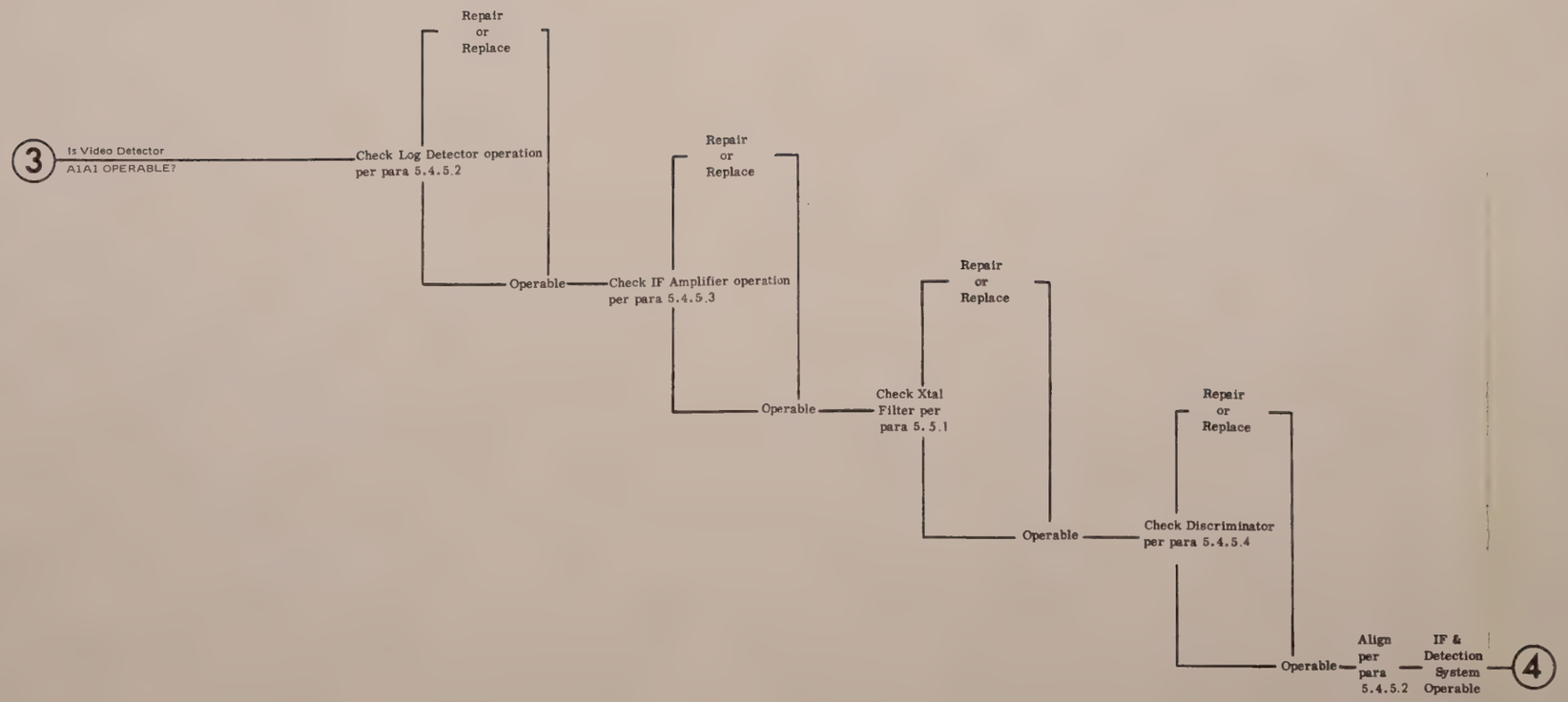


Figure 5.5. IF and Detection System Checking

5.4.1.3 COMPONENT REPLACEMENT

1. The Reference Data section provides all the information necessary to narrow the trouble spot to individual component replacement.

2. The Theory of Operation section provides circuit function and operating principles that may be used as an aid to malfunction location and correction.

5.4.1.4 PRINTED CIRCUIT BOARD PRECAUTIONS

1. Do not remove circuit boards while POWER switch is ON; switch should be OFF (down) and all external power disconnected.

2. Never touch the printed surface with bare fingers; skin oils can create leakage paths.

3. Use a grounded soldering iron to avoid destruction of semi-conductors.

4. Avoid excessive heat when repairing a board.

5. After repair, clean the printed surface of all contaminants, excess solder and resin using a Freon-base cleaner. Be sure that excess solder has not created new circuit paths.

5.4.2 REPAIR SEQUENCE GUIDE (Fig. 5.2)

Figure 5.2 illustrates the order in which EMC-25 repair must be performed. Circuitry within the EMC-25 is interdependent, therefore repair and alignment must be performed in the sequence stated below:

a) Use Table 5-1 to determine whether the fault can be corrected without opening the instrument, or if access to the interior is necessary.

b) If access is required to the interior of the instrument, see Section 5.5.1 and proceed to the next leg of the Repair Sequency Guide, Power Supply. Use the Power Supply Checking Figure 5.4 to determine if the Power Supply is operating correctly.

c) After the Power Supply has been checked and/or corrected, proceed to the next leg, IF and Detection Circuitry check. Use Figure 5.5 to determine if the IF and Detection System is operating properly.

d) After the IF and Detection System has been checked and/or corrected and aligned, proceed to the next leg, Calibrator and RF Tuner Circuitry check. Use Figure 5.6 to determine if the Calibrator and RF Tuner circuits are operating properly.

e) After the Calibrator and RF Tuner Circuits have been checked and/or corrected and aligned, proceed to the final leg, Specification check. Return to Section IV and check all specifications by performing each test.

5.4.3 COMMON FAULTS (Table 5-1)

Table 5-1 lists the most common faults found during performance tests and during normal operation. Perform the checks in the order indicated on the Table.

5.4.3.1 BATTERY TEST (OPTIONAL)

Press Bat. test button and check the Battery indicator (front panel). If the meter reads oper the battery is operable; if not, the battery needs charging. Charge the battery according to the procedure in Section III.

5.4.3.2 CONTROL SETTINGS

Check the control settings on the front panel with the operation procedure being used in Section III.

5.4.3.3 OPERATIONAL ERRORS

It is recommended that the operator be completely familiar with Section III Operating Instructions and Accessory Operation.

5.4.3.4 CJB-252 (Optional)

Check carefully the connections and the procedure used for operation with the CJB-252

5.4.3.5 TEST EQUIPMENT ACCURACY

It is imperative that the test equipment accuracy be commensurate with the parameters being measured and all sources of error be carefully computed.

5.4.3.6 REMOTE CONNECTOR VOLTAGES

A voltage check at the pins listed below on the REMOTE connector with the DUMMY PLUG removed will assure the correct voltages from the battery and regulators for proper operation.

TABLE 5-1

PERFORMANCE TEST FAILURE:	Perform these tests left to right: ✓									
	BAT. TEST	Control Settings	Operator Error	Instrument Not ± 300 of Horizontal	Improper Use of CJB-252	Test Equipment Accuracy			Check Voltages REMOTE Connector	Access To Interior May Be Required
1. Voltage Accuracy										
a. All Bands	✓	✓	✓	✓	✓	✓			✓	
b. Bands 1-7				✓						✓
c. Bands 8-10				✓						✓
d. Bands 11-15				✓						✓
e. Band 4										✓
f. Any Single Band			✓	✓		✓				✓
g. Calibrator Inoperative		✓		✓	✓					
2. Frequency Accuracy										
a. All Bands	✓	✓	✓		✓	✓			✓	✓
b. Individual Band	✓	✓	✓			✓			✓	✓
3. Attenuation										✓
4. CW + IG Sensitivity										
a. All Bands	✓	✓	✓	✓	✓	✓			✓	
b. Several Bands			✓	✓		✓				✓
5. Bandwidth	✓		✓		✓	✓			✓	
6. Meter Tracking	✓	✓	✓			✓			✓	✓
7. Image Rejection										✓
8. IF Rejection										✓
9. Spurious Responses	✓								✓	✓
10. Sweep Time	✓				✓				✓	
OTHER FAILURES:										
1. Meter Pins + or -	✓				✓				✓	✓
2. Accessories Do Not Operate	✓	✓			✓				✓	
3. Will Not Tune		✓								
4. Transients While Tuning										✓

TABLE 5-2

REMOTE CONNECTOR VOLTAGES

PIN	DC VOLTAGE
AA	GND
EE	+110V min.
V	+11.9V to +12.1V
X	-5.9V to 6.1V
HH	+15V min.
CC	-9V min.

5.4.3.7 ACCESS
(See Section 5.5.1)

5.4.4 POWER SUPPLY CHECKING (Table 5-3)

Terminal Board A5TB1 is the main distribution for the Power Supply. Table 5-3 lists each terminal voltage, isolation from ground, and conditions under which the voltages appear. All voltages are nominal unless limits are shown. Polarity of the ohmmeter used to measure resistance from the terminals to ground must be the same polarity as the voltmeter used to measure DC voltages.

The Power Supply chassis may be removed by loosening two quarter-turn fasteners and pulling the chassis free from the EMC-25 housing.

5.4.4.1 CHARGER ADJUSTMENT PROCEDURE (With Optional Battery)

NOTE:

Before proceeding with the following, be sure A.C. power to receiver has been disconnected for at least 8 to 10 hours to bring battery back to room temperature. Front panel power switch must be off to perform following.

a. Disconnect the unit from the AC power source.

b. Remove the new current regulator board (charger board) and insert it into a 22 pin extender plugged into the socket from which the board was removed.

c. Temporarily connect a 68Kohm, ¼, ±10% resistor between pins 14 and 21 of the charger board socket.

d. Restore connection to AC power.

e. Adjust 10k trimpot on new charger board until the two charger bulbs are at the threshold of extinction.

f. Again remove connection to AC power.

g. Restore the charger board to its normal socket.

h. Reconnect to AC power and resume normal operation.

5.4.5 IF AND DETECTION SYSTEM CHECKING

5.4.5.1 VIDEO DETECTOR, (A1A1)

a. Remove cable #4 from the rear of the Video Detector.

b. Rotate the DETECTOR FUNCTION switch to the CARR position.

c. Rotate the DETECTOR FUNCTION switch to the PEAK position and turn the DWELL control ON. The meter should read near "0."

d. Return the DETECTOR FUNCTION switch to CARR. The meter should continue to read "0".

e. Apply +1.5 VDC to the connector where cable #4 was connected to the Video Detector. This should produce an approximate full scale reading on the meter.

f. Reconnect cable #4.

5.4.5.2 LOG DETECTOR

a. Remove the brace from the Log Detector, IF Amplifier and Discriminator and loosen the six-quarter-turn fasteners.

b. Make sure the harnesses are free from the clamps on the Discriminator chassis.

c. Lay a piece of masonite atop the bottom of the instrument.

d. Lift the three chassis from the EMC-25 and place them on the board with the Log Amplifier on top.

e. Remove cable #8 from J3, cable #7 from J2, and cable #6 from J1 on the Log Detector chassis.

f. Set the front panel control as follows:

DETECTOR FUNCTION – CARR

g. Set the BAND selector to the Band 1 position for 175 kHZ alignment and connect a signal generator to J3. Set its output to 72.5 mV. (This is an indicated output into a 50-ohm load. The actual output will be approximately 6 dB higher.)

h. Adjust A1R51 on the Log Detector for 0 dB on the meter.

i. Reduce the signal generator by 30 dB.

j. Adjust A1R45 for -30 dB on the meter.

TABLE 5-3

TERMINAL NUMBER	FUNCTION	DC VOLTS	MIN. RESISTANCE (OHMS)
1	Motor On	+4 During Step	4K
2	Band Step ↓	+12 " "	10K
3	Band Step ↑	+12 " "	10K
4	-Raw	-15	250
5	+Raw	+24	800
6	.1NB Control	+12 During .1NB	60
7	+HV Raw	+110 - +200	200K
8	Bandwidth Control	-6WB/+12NB	60
9	Low Voltage Tune	0 to 1.5 varies with Tuning	1.5K
10	+ Regulated	+11.95 to +12.05	150
11	- Regulated	-5.95 to + 6.05	60
12	Cal Control	+7 to 12 varies with Cal	60Ω to 50K
13	IF Atten. #1 Control	-12 0/20db pos.	390
14	IF Atten. #2 "	-12 Remote + 20/40 Pos.	390
15	Ground	0	0
16	Preamp Select	-6 Band 1-7	60
17	" "	-6 " 8-10	60
18	" "	-6 " 11-15	60
19	High Voltage Tune	+0.3 to 101 varies with Tuning	25K
20	IF Amp & Disc. Select	-6 Band 1-7	60
21	" " " "	-6 Band 8-10	60
22	" " " "	-6 Bands 11-15	60
23	Ground	0	0
24	+Regulated	+11.95 to +12.05	150
25	Bandwidth Select	-6WB/+12NB	60
26	Spare	0	
27	Spare	0	
28	Spare	0	
29	Log Det. Select	-6 Band 1-7	60
30	" " "	-6 " 8-10	60
31	" " "	-6 " 11-15	60
32	Ground	0	0
33	+Regulated	+11.95 to +12.05	150
34	.1NB Select	+12 During .1NB	60

k. Repeat steps 7 through 10 until the meter linearity meets a specification of ±1 dB above 0 dB and ±2 dB below 0 dB on the meter.

l. Switch to the Band 8 position for 1.6 MHz alignment.

m. Set the signal generator to 1.6 MHz with a 7.25mV output and connect it to J2.

n. Adjust A2R51 for 0 dB on the EMC-25 meter.

o. Reduce the signal generator output by 30 dB.

p. Adjust A2R45 for -30 dB on the EMC-25 meter.

q. Repeat steps 13 through 16 until the meter linearity meets a specification ±1 dB above 0 dB and ±2 dB below 0 dB on the meter.

r. Switch to the Band 11 position for 8.7 MHz alignment.

s. Set the signal generator to 8.7 MHz with a 3.15 mV output and connect it to J1.

t. Adjust A3R51 for 0 dB on the EMC-25 meter.

u. Reduce the signal generator output by 30 dB.

v. Adjust A3R45 for -30 dB on the EMC-25 meter.

w. Repeat steps 19 through 22 until meter linearity meets a specification of ±1 dB above 0 dB and ±2 dB below 0 dB on the meter.

x. Reconnect all cables, but do not replace the chassis in the unit.

NOTE

This is a preliminary adjustment to assure proper operation of the Log and Video Detector. Final adjustment accurs when the IF and DETECTION SYSTEM is interconnected.

5.4.5.3 IF AMPLIFIER

The IF Amplifier alignment determines the bandwidth and gain and contributes to several other important parameters as well. This alignment is extremely stable and should not be disturbed unless one or more of the frequency determining elements are replaced. Center frequency must be accurate to ±0.5 dB.

In N option instruments, IF Amplifiers are aligned for approximately 3 dB higher gain than normal instruments. The higher gain is obtained through an increase in the value of C21. In an N option instrument, the frequency to which the aligning signal generator is tuned is set by tuning it for maximum response on the EMC-25 while in the 0.1 NB position.

The procedure below applies only to realignment of a previously operative IF Amplifier. Initial factory alignment is considerably more complex.

5.4.5.3.1 175 kHz Amplifier Alignment

a. Set the EMC-25 controls:

BANDWIDTH	— NARROW
DETECTOR FUNCTION	— CARR
BAND Selector	— Any 1—7

b. Remove cable #15 from the RF Tuner and connect it to a signal generator. Set the signal generator to 220 μV output at 175 kHZ.

c. Tune all the inductors for maximum indication on the EMC-25 meter in the following order: L2004, L2010, L2009, L2008, L2007, L2006, L2005, L2003, L2002, and L2001.

d. Change the BANDWIDTH switch to WIDE. The meter should change less than ±0.5 dB. Note the meter reading.

e. If the meter reading is not within ±1 dB of full scale, A3A1C21 should be adjusted for full scale indication.

f. If the difference in meter reading is greater than ±0.5 dB, A3A1R6 will have to be adjusted for proper NARROW gain.

g. Repeat step c.) if steps e.) or f.) are performed.

h. Change the BANDWIDTH switch to NARROW and note the EMC-25 meter reading.

i. Increase the signal generator output by 3 dB. Tune it both higher and lower in frequency, noting the frequencies at which the EMC-25 meter reading is the same as in step h. The difference between these frequencies is the NARROW bandwidth.

j. If the bandwidth is not between 450 Hz and 550 Hz, A3A1R11 will have to be adjusted, followed by a repetition of step f.

5.4.5.3.2 1.6 MHz Alignment

a. Set the EMC-25 controls:

BANDWIDTH	– NARROW
DETECTOR FUNCTION	– CARR
BAND Selector	– Any 8–10

b. Remove cable #15 from the RF Tuner and connect it to a signal generator. Set the signal generator to 700 uV output at 1.6 MHz.

c. Tune C4 for a minimum indication (null) on the EMC-25 meter.

d. Tune all the inductors for maximum indication on the EMC-25 meter in the following order: L3004, L3010, L3009, L3008, L3007, L3006, L3005, L3003, L3002, and L3001.

e. Tune C4 for a maximum indication on the EMC-25 meter.

f. Reduce the output of the signal generator until the EMC-25 meter reads +20 dB.

g. Tune C4 until the EMC-25 meter reads +18 dB.

h. Change the BANDWIDTH switch to WIDE. Reset the signal generator to 700 uV output. Note the EMC-25 meter reading.

i. If the EMC-25 meter reading is above the +20 dB mark, continue to change C4 until it reads +20 dB. If it is below +19 dB, A3A2C21 should be adjusted to raise it to approximately +20 dB.

j. Change the BANDWIDTH switch to NARROW. The meter should change less than +0.5 dB.

k. If the difference between WIDE and NARROW is greater than ±0.5 dB, A3A2R7 will have to be adjusted. Retune L3004 if A3A2R7 is changed.

l. Leave the BANDWIDTH switch in the NARROW position and note the EMC-25 meter reading.

m. Increase the signal generator output by 3 dB. Tune it both higher and lower in frequency, noting the frequencies at which the EMC-25 meter reading is the same as in step one. The difference between these is the narrow bandwidth.

n. If the bandwidth is not between 4.5 kHZ and 5.5 kHz, A3A2R12 will have to be adjusted, followed by a repetition of step k.

5.4.5.3.3 8.7 MHz Alignment

a. Set the EMC-25 controls:

BANDWIDTH	– NARROW
DETECTOR FUNCTION	– CARR
BAND Selector	– Any 11–15

b. Remove cable #15 from the RF Tuner and connect it to a signal generator. Set the signal generator to 2.0 mV output at 8.7 MHz.

c. Tune all the inductors for maximum indication on the EMC-25 meter in the following order. L4004, L4010, L4009, L4008, L4007, L4006, L4005, L4003, L4002, and L4001.

d. Tune C4, C21, C26 and C33 for minimum indication on the EMC-25 meter.

e. Change the BANDWIDTH switch to WIDE. Note the EMC-25 meter reading.

f. Tune C26 and C33 individually for maximum EMC-25 meter reading and note the *increase* in each case.

g. Tune C26 and C33 for minimum indication on the EMC-25 meter.

h. Tune C4 and C21 individually for maximum EMC-25 meter indication, then reduce *each* 3 dB.

i. Note the difference between the EMC-25 meter reading and +20 dB (full scale). Increase C26 and C33 by equal amounts to cause the EMC-25 meter to read +20 dB, but in no case increase them closer than 2 dB to their maximum range determined in steps e. and f.

j. If the EMC-25 meter reading cannot be increased to +20dB in step i., C4 and C21 may each be increased as much as 1 dB.

k. If the EMC-25 meter reading still cannot be increased to +20 dB, then A3A3R25 may be decreased in value.

l. Change the BANDWIDTH switch to NARROW. The meter should change less than ±0.5 dB.

m. If the difference between WIDE and NARROW is greater than ±0.5 dB, A3A3R6 will have to be adjusted. Retune L4005 if A3A3R6 is changed.

n. Leave the BANDWIDTH switch in the NARROW position and note the EMC-25 meter reading.

o. Increase the signal output by 3 dB. Tune it both higher and lower in frequency, noting

the frequencies at which the EMC-25 meter reading is the same as in step n. The difference between these is the narrow bandwidth.

p. If the bandwidth is not between 45 kHz and 55 kHz, A3A3R11 will have to be adjusted, followed by a repetition of steps l. and m.

5.4.5.4 N Option (Crystal Filter) Alignment

a. Set the EMC-25 controls:

BANDWIDTH	— 0.1 NARROW
DETECTOR FUNCTION	— CARR

BAND Selector

— Band 1 when adjusting 175 KHZ.

— Band 8 when adjusting 1.6 MHz.

— Band 11 when adjusting 8.7 MHz.

b. Remove cable #15 from the RF Tuner and connect it to a signal generator capable of tuning to the three IF frequencies. Tune the signal generator to obtain a maximum response on the EMC-25 meter and adjust its level for a meter reading of 0 dB.

c. Disconnect the filter assembly (A10) from the circuit by connecting the three IF Amplifier outputs directly to the three Log Detector inputs.

d. Leaving the BANDWIDTH switch in the 0.1 NARROW position, note whether the meter reading is still 0 dB.

e. If the meter reading is not 0 dB, the amplifier gain control needs adjustment as described in steps 6. through 8. If the reading is 0 dB, proceed to steps 7. and 9.

f. Without touching the frequency control of the signal generator, change the amplitude until the meter reads 0 dB.

g. Reconnect the filter assembly (A10).

h. Adjust R59 (175 kHz), R37 (1.6 MHz) or R14 (8.7 MHz) until a 0 dB meter reading is realized in each case.

i. Change the BANDWIDTH switch to the WB position and note any change in the meter reading.

j. If the meter reading changes by greater than ±1 dB, the bypass gain control needs adjustment as follows:

k. Adjust R48 (175 kHz), R26 (1.6 MHz), or R3 (8.7 MHz) until the meter reading is once again 0 dB in each case.

5.4.5.5 Discriminator Alignment

Discriminator alignment is extremely stable. Realignment should be performed only when a signal on Band 7, 10, and 14 cannot be satisfactorily acquired and locked with AFC as described in Section III, or when IF Amplifier is realigned.

5.4.5.5.1 175 kHz Discriminator

a. Set the EMC-25 controls:

BAND	— 1–7
BANDWIDTH	— WIDE
DETECTOR FUNCTION	— CARR

b. Disconnect cable #15 from the RF Tuner and connect it to a signal generator.

c. Disconnect cable #5 from the rear of the Video Detector and connect it to a voltmeter with a resolution of 4 digits at 1.500 volts.

d. Tune the signal generator to 175.0 kHz and adjust its output level to cause the EMC-25 meter to read 0 dB.

e. Adjust T2003 for 0.000 volts indication.

f. Change the signal generator frequency to 172.5 kHz and note the negative voltage (normal reading is – 1.0 to – 1.5 volts).

g. Change the signal generator frequency to 177.5 kHz and note the positive voltage. If it is not the same as that noted in step f., adjust T2002.

h. Interaction between T2002 and T2003 will necessitate the repetition of steps d. through g.

i. T2001 tunes very broadly and needs to be aligned only if it is replaced. To tune it, connect a high impedance DC voltmeter to the junction of C11 and C12; set frequency level per step d. and tune for peak indication on the voltmeter.

5.4.5.5.2 1.6 MHz Discriminator

a. Set the EMC-25 controls:

BAND	— 8–10
BANDWIDTH	— WIDE
DETECTOR FUNCTION	— CARR

b. Disconnect cable #15 from the RF Tuner and connect it to a signal generator.

c. Disconnect cable #5 from the rear of the Video Detector and connect it to a voltmeter with a resolution of 4 digits at 15.00 volts.

d. Tune the signal generator to 1.600 MHz and adjust its output level to cause the EMC-25 meter to read 0 dB.

e. Adjust T3003 for 0.000 volts indication.

f. Change the signal generator frequency to 1.575 MHz and note the negative voltage (normal reading is −1.5 to −2.0 volts).

g. Change the signal generator frequency to 1.625 MHz and note the positive voltage. If it is not the same as that noted in step f., adjust T3002.

h. Interaction between T3002 and T3003 will necessitate the repetition of steps d. through g.

i. T3001 tunes very broadly and needs to be aligned only if it or C2 is replaced. To tune it, connect a high impedance DC voltmeter to the junction of C8 and C9; set frequency and level per step d. and tune for peak indication on the voltmeter.

5.4.5.5.3 8.7 MHz Discriminator

a. Set the EMC-25 controls:

BAND	— 11—15
BANDWIDTH	— WIDE
DETECTOR FUNCTION	— CARR

b. Disconnect cable #15 from the RF Tuner and connect it to a signal generator.

c. Disconnect cable #5 from the rear of the Video Detector and connect it to a voltmeter with a resolution of 4 digits at 15.00 volts.

d. Tune the signal generator to 8.7000 MHz and adjust its output level to cause the EMC-25 meter to read 0 dB.

e. Adjust T4003 for 0.000 volts indication.

f. Change the signal generator frequency to 8.450 MHz and note the negative voltage (normal reading is −1.5 to −2.5 volts).

g. Change the signal generator frequency to 8.950 MHz and note the positive voltage. If it is not the same as that noted in step f., adjust T4002.

h. Interaction between T4002 and T4003 will necessitate the repetition of steps d. through g.

i. T4001 tunes very broadly and need be aligned only if it or C2 is replaced. To tune it, connect a high impedance DC voltmeter to the junction of C8 and C9; set frequency and level per step d. and tune for peak indication on the voltmeter.

5.4.5.6 Log Detector Touch-Up

This alignment corrects for IF Amplifier non-linearity and is performed only after the Video Detector, Log Detector, Crystal Filter and IF Amplifier prove operable.

1. Set the BAND selector to the Band 1 position for 175 kHz alignment.

2. Set the BANDWIDTH switch in the NARROW position.

3. Connect a signal generator to the IF Amplifier input cable #15; set the generator to 175 kHz with a 22 mV and tune it for a peak response on the EMC-25 meter.

4. Adjust A1R51 on the Log Detector for 0 dB on the meter.

5. Reduce the signal generator output by 30 dB.

6. Adjust A1R45 for −30 dB on the EMC-25 meter.

7. Repeat steps 4 thru 6 until the meter linearity meets a specification of .±0.1 dB about 0 dB and ±0.2 dB below 0 dB on the meter.

8. Switch to the Band 8 position for 1.6 MHz alignment.

9. Set the signal generator to 1.6 MHz with a 700μV output and tune it for a peak response on the EMC-25 meter.

10. Adjust A2R51 for 0 dB on the EMC-25 meter.

11. Reduce the signal generator output by 30 dB.

12. Adjust A2R45 for −30 dB on the EMC-25 meter.

13. Repeat steps 10 through 12 until the meter linearity meets a specification of ±0.1 dB above 0 dB and ±0.2 dB below 0 dB on the meter.

14. Switch to the Band 11 position for 8.7 MHz alignment.

15. Set the signal generator to 8.7 MHz with a 0.2 mV output and tune it for a peak response on the EMC-25 meter.

16. Adjust A3R51 for 0 dB on the EMC-25 meter.

17. Reduce the signal generator output by 30 dB.

18. Adjust A3R45 for −30 dB on the EMC-25 meter.

19. Repeat steps 16 through 18 until meter linearity meets a specification of ±0.1 dB above 0 dB and ±0.2 dB below 0 dB on the meter.

5.4.6 CALIBRATION — RF TUNER CHECK

Refer to Fig. 5.6 (Page 5-15)

Procedures a., b., and c., affect the frequency accuracy of the EMC-25. Do not perform these procedures if the Frequency Accuracy Test (4.4.4) results are satisfactory. Step a. affects all bands, while steps b. and c. chiefly affect the low-frequency end of bands 1-10. Should a single band be out of alignment, see Section 5.4.7 and follow that procedure for individual bandstrip alignment.

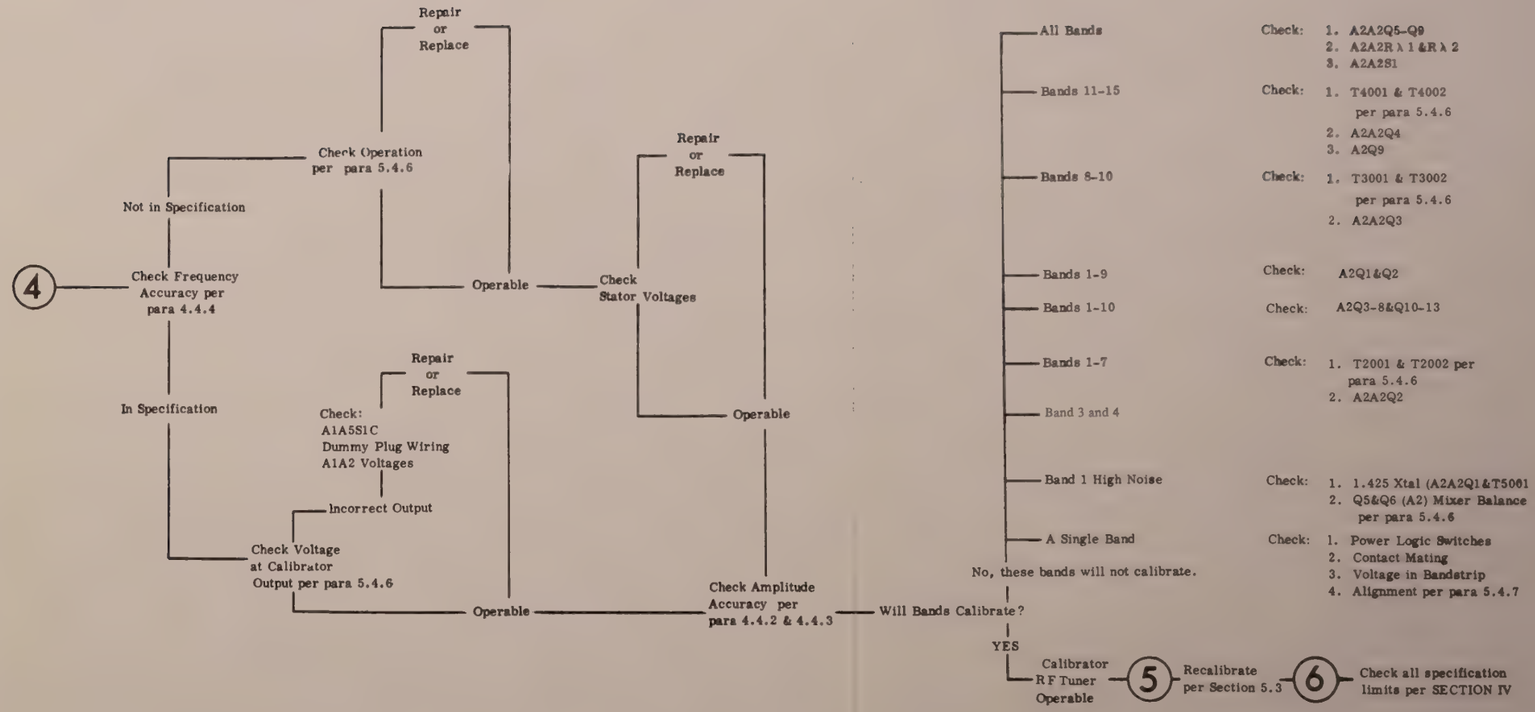


Figure 5.6 Calibrator and RF Tuner Checking

The frequency scales of bands 1-10 are precalibrated on a standard printed form and the frequency scales of bands 11-15 are hand drawn. Therefore, when a band in the 1-10 range needs alignment, adjust the alignment to match the printed scale. However, when a band in the 11-15 range needs alignment, usually a new scale must be drawn. Procedures are not stated here for redrawing the 11-15 scales due to the special processes and equipment utilized.

5.4.6.1 Tuning Voltage (Sweep Board Adjustment)

1. Set the Band selector in the Band 4 position.

2. Set the Fine Tune control to mechanical center.

3. Connect a voltmeter between terminal #11 on A5TB1A and ground.

4. Adjustments are made on the Sweep Board (A1P1) behind the EMC-25 meter, Figure 5.3, Page 5-4.

5. Set the freq. control (dial cursor) to the low frequency end, mechanical stop (right side, unit upside down).

6. Adjust the right-hand, low freq. potentiometer for "0" volts.

7. Reset the freq. control (dial cursor) to the low freq. end of horizontal dial line. Connect the voltmeter to the TV test point on the RF tuner bracket and adjust potentiometer on the tune regulator board (A5P4) for a "0" reading on the voltmeter.

8. Reset the Freq. control (dial cursor) to the high freq. end of the horizontal dial line. Adjust high freq. potentiometer left hand pot, on sweep board A1P1 for 98 volts on voltmeter. Repeat steps 5 thru 8 until voltage condition has been satisfied.

9. Sweep adjustments. Set the tuning mode switch in the sweep position.

10. Monitor voltage at TV test point and adjust R-13, center pot for 98.5 volts at time voltage trips to "0."

11. Set sweep time control to 30 minutes.

12. Connect voltmeter from junction of R-22 — R23 to junction of R17 — R19 on sweep board (A1P1).

13. Adjust potentiometer R19 (slow sweep) right side of center pot, for voltmeter reading of 0.58 volts.

14. Set Sweep Time control to one minute.

15. Adjust potentiometer R27 (fast sweep) left side of center pot, for voltmeter reading of 1.7 volts. Slow and fast sweep limits are now adjusted.

16. To calibrate sweep time more accurately, use a watch with a sweep second-hand and percentage of sweep increments on EMC-25 meter face. Example: Set sweep time control to one minute. Press and release sweep start switch as the watch sweep second-hand crosses a predetermined number. Watch the percentage sweep increments on the EMC-25 meter face. When the EMC-25 meter needle crosses 50 percent sweep, the watch sweep second-hand should indicate 30 seconds elapsed time. Check at 80 and 100%.

5.4.6.2 Varactor Bias

1. Varactor biasing is set by adjusting bias networks mounted on the stator board. Biasing is preset by factory selected resistors in bias networks. Bias voltage ranges from −0.2 to −1.0 volt.

5.4.6.3 Oscillator Level

Connect an oscilloscope to pin #23 of the 30 contact pins for the band segments and adjust the oscillator level control R52, at the rear of the RF Tuner for 400 mV peak-to-peak for bands 1—10. This voltage should not vary more than ±1 dB at any frequency, 10 kHz — 25 MHz.

5.4.6.4 Calibrator DC Voltage

If the calibrator output level improper, the DC contact voltage should be measured at pin 7 of A1A2J1.

A voltage (±10%) of +3.5 VDC for bands 8-15 will appear, and +20 VDC for bands 1—7.

5.4.6.5 Mixer Balance

1. With the RF INPUT free of any connections, set the EMC-25 to the Band 1 position, the FREQUENCY selector to the low end stop, the BANDWIDTH switch in WIDE and the CAL control fully CW.

2. Adjust the Mixer Balance Control R38 at the rear of the RF TUNER until the front panel meter reaches a null (minimum) indication.

5.4.6.6 175 kHz Mixer and Pre Amp Tuning

1. Set the EMC-25 controls as follows:

BAND SELECTOR	— Band 2
FREQUENCY	—120 kHz
TUNING MODE	— MAN
DETECTOR FUNCTION	— CARR
BANDWIDTH	— NARROW

2. Connect a signal to the RF INPUT connector, tune it to 175 kHz, and starting at minimum, gradually increase the output level until the EMC-25 meter reads approximately 0 dB. Tune the signal generator for a peak response on the EMC-25 meter.

3. Adjust T2001, the 175 kHz Mixer transformer at the rear of the RF Tuner until the meter reaches a peak indication.

4. Refer to the schematic diagram of the Pre Amp board and adjust T2002, the 175 kHz adjustment on the Pre Amp board until the meter reaches a peak indication.

5.4.6.7 1.6 MHz Mixer and Pre Amp Tuning

1. Set the EMC-25 controls as follows:

BAND SELECTOR	— Band 8
FREQUENCY	— 2.5 MHz
TUNING MODE	— MAN
DETECTOR FUNCTION	— CARR
BANDWIDTH	— NARROW

2. Connect a signal generator to the RF INPUT connector, tune it to 1.6 MHZ, and starting at minimum gradually increase the output level until the EMC-25 meter reads approximately 0 dB. Tune the signal generator for a peak response on the EMC-25 meter.

3. Adjust the T3001 1.6 MHz Mixer transformer at the rear of the RF Tuner, until the meter reaches a peak indication.

4. Refer to the schematic diagram of the Pre Amp board and adjust T3002, the 1.6 MHz adjustment on the Pre Amp board until the meter reaches a peak indication.

5.4.6.8 8.7 MHz Mixer and Pre Amp Tuning

1. Set the EMC-25 controls as follows:

BAND SELECTOR	— Band 11
FREQUENCY	— 25 MHz
TUNING MODE	— MAN
DETECTOR FUNCTION	— CARR
BANDWIDTH	— NARROW

2. Connect a signal generator to the RF INPUT connector, tune it to 8.7 MHz, and starting at minimum, gradually increase the output level until the EMC-25 meter reads approximately 0 dB. Tune the signal generator for a peak response on the EMC-25.

3. Adjust the T4001 8.7 MHz Mixer transformer, located on the section behind the 30 contact pins for the band segments, until the meter reaches a peak indication.

4. Refer to the schematic diagram of the Pre Amp board and adjust T4002, the 8.7 MHz adjustment on the Pre Amp Board until the meter reaches a peak indication.

5.4.7 BAND SEGMENTS

NOTES

1. To obtain access to the band being aligned, it may be necessary to remove certain bands from the turret.
2. Contact pins are numbered 1 through 30 from left to right when viewed from the front panel, with EMC-25 upside down.
3. Set the EMC-25 front panel controls as follows:

ATTENUATOR	— 20 dB (Black)
FINE TUNE	— Mechanical Center
TUNING MODE	— MAN
CAL Control	— FULLY CCW
BANDWIDTH	— WIDE
DETECTOR FUNCTION	— CARR
AUDIO	— FULLY CCW
POWER	— ON (Up)

5.4.7.1 BANDS 1 — 9:

1. Connect a signal generator to the RF INPUT connector and set the output to 10 μV. Tune the EMC-25 and the signal generator to the first indicated frequency line of each band. Ex. Band 1, 10 kHz; Band 2, 35 kHz) and apply a signal.

2. Adjust the coil and trimmer pad nearest pin #30 (right side) for a peak indication on the front panel meter. This is local oscillator and will affect freq. only.

3. Adjust each coil starting from the opposite end of the band (nearest pin #1) until the meter is at maximum deflection.

4. Change the EMC-25 FREQ control to the last indicated line of each band and change the signal generator frequency accordingly.

5. Adjust the capacitor nearest pin #30 (right side) for a peak indication on the front panel meter. Local oscillator, adjust for freq. only.

6. Adjust each capacitor starting from the opposite end of the band (nearest pin #1) until the meter is at maximum deflection.

5.4.7.2 BAND 10

1. Connect a signal generator to the RF INPUT connector and set the output to 10 μV. Tune the signal generator and the EMC-25 to 11 MHz and apply the signal.

2. Adjust T3 for a peak indication on the front panel meter. Local oscillator, adjust for freq. only.

3. Adjust T1, T2, L1 and L2 respectively, until the meter is at maximum deflection.

4. Change the signal generator and the EMC-25 FREQ control to 25 MHz and apply the signal.

5. Adjust capacitor C24 for a peak indication on the front panel meter. Local oscillator, adjust for freq. only.

6. Adjust capacitors C1, C7, C14 and C17 respectively until the meter is at maximum deflection.

5.4.7.3 BAND 11

1. Connect a signal generator to the RF INPUT connector and set the output to 100μV. Tune the signal generator and the EMC-25 to 52.5 MHz and apply the signal.

2. Adjust C39 for a peak indication on the front panel meter. Local oscillator, adjust for freq. only.

3. Change the signal generator and the EMC-25 FREQ control to 25 MHz and apply the signal.

4. Adjust T1, L1 and L2 respectively, until the meter is at maximum deflection.

5. Change the signal generator and the EMC-25 FREQ control to 50 MHz and apply the signal.

6. Adjust capacitors C2, C11 and C25 respectively until the meter is at its maximum deflection.

5.4.7.4 BAND 12

1. Connect a signal generator to the RF INPUT connector and to the RF INPUT connector and set the output to 100μV. TUNE the SIGNAL GENERATOR and the EMC-25 to 48 MHz and apply the signal.

2. Adjust C39 for a peak indication on the front panel meter. Local oscillator, adjust for freq. only.

3. Change the signal generator and the EMC-25 FREQ control to 102 MHz and apply the signal.

4. Adjust C45 for a peak indication on the front panel meter.

5. Change the signal generator and the EMC-25 FREQUENCY control to 48 MHz and apply the signal to the 2nd RF Amp between T2 and C14.

6. Adjust T3 for a peak indication on the meter.

7. Change the frequency to 102 MHz and apply the signal to the 2nd RF Amp.

8. Adjust C25 for a peak indication on the meter.

9. Change the frequency to 48 MHz and apply the signal to the 1st RF Amp between L1 and C4.

10. Adjust T2 for a peak indication on the meter.

11. Change the frequency to 102 MHz and apply the signal to the 1st RF Amp.

12. Adjust C8 for a peak indication on the meter.

13. Change the frequency of the signal generator and the EMC-25 to 48 MHz and apply the signal to the RF INPUT.

14. Adjust T1, T2, and T3 respectively until the meter is at maximum deflection.

15. Change the frequency of the signal generator and the EMC-25 to 102 MHz and apply the signal to the RF INPUT.

16. Adjust C2, C8, and C25 respectively until the meter is at maximum deflection.

17. After replacing the band segment cover, it may be necessary to repeat steps 13 through 16.

5.4.7.5 BAND 13, 14, and 15

Proper operation of Band 13, 14 and 15 band strips depends upon the arrangement of components and short lead lengths. Due to the critical nature of these circuits, field repair is not recommended. Schematic diagrams are included in Section VI as an aid to understanding EMC-25 operation and for emergency repair only.

5.5 EMC-25N (N Option) MODIFICATIONS AND ALIGNMENT PROCEDURE

The following information relates to any EMC-25 incorporating the N modification. All EMC-25N equipment incorporate the following modifications:

Figure 6.13, Discriminator (A8) Schematic Diagram

1. 8.7 MHz IF Band –

a. Input capacitor C2 is deleted.
b. Damping resistor R1 is changed from 220 ohms to 1K ohms.
c. Emitter resistor R2 is changed from 470 ohms to 680 ohms.
d. Resistor R8 is deleted.

2. 1.6 MHz Band –

a. Input damping resistor is deleted.

b. Change resistor R8 from 12K ohms to 27K ohms.

3. 175 kHz IF Band –

a. Input resistor R1 is deleted.

b. A 680 pF capacitor is added across Input Secondary T-2001.

Figure 6.14 Video Detector (A1A1) Schematic Diagram.

Figure 6.15 Control Section (A1) Schematic Diagram

1. Sweep Tune Board –

a. A jumper is placed between pin 10 and pin 20 on sweep tune board socket (pin 10 is used only on that equipment that incorporates the N modification).

Modification for video detector above pertains to Video-2 only. Mark II video has audio circuit removed and replaced with emitter follower circuit.

2. Audio Board –

a. Wire from output of PC board to phone jack and remote plug is removed and is replaced between the shielded wire ground on shielded wire connect to the ground lug on the audio board holder.

3. Front Panel Module –

a. Audio Control (volume) modifications refer to R-3 units only.

5.5.1 N OPTION EMC-25 ALIGNMENT

Following are additional alignment instructions for N Version EMC-25s. This procedure does not include the adjustment of the narrowband filter unit.

AFC Adjustments: (Each IF Frequency)

1. Connect a sensitive DC coupled oscilloscope to the AFC output terminal of the Video Detector (feed thru capacitor C22 on the right-hand rear side of Video Detector).

2. Set bandwidth switch to WIDE, AFC switch to OFF, ATTENUATOR in CAL, Tuning to MAN, Tuning Mode OFF, Detector Function to CARR.

3. Feed in a full scale CW signal from a signal generator. Slowly sweep the frequency of the generator back and forth across the frequency to which the receiver is tuned, noting the symmetry of the discriminator output on the scope.

4. Adjust the Discriminator Transformers T 002 and T 003 so that the peak positive and peak negative output voltage swings are symmetrical about the noise line, and also so that, when the signal generator voltage is adjusted for maximum meter deflection, the discriminator output voltage as indicated on the scope is the same as the mean noise base line viewed when the input signal frequency is far from the resonant frequency to which the receiver is tuned.

5. Now turn the bandwidth switch to 0.1 NB. With no signal tuned in, adjust the sensitivity and positioning of the scope so that noise of 2 to 3 cm is presented in the center position of the screen.

6. Adjust the discriminator input transformer T 001 for a minimum noise level, and for symmetry in the noise wave shape about the base line.

7. Now very slowly vary the signal generator back and forth across the resonant frequency to which the receiver is tuned. Make slight adjustments to discriminator T 003 so that the small portion of the discriminator curve which is now present (because of the 0.1 NB filter) is symmetrically centered around the mean noise level.

8. Now turn the AFC switch to "ON." Carefully tune and fine-tune the receiver until it has acquired the signal, and it is adjusted for maximum amplitude. Now remove the input signal momentarily, (disconnect the input), then reconnect it and note if the signal is recaptured. If not, a careful trial and error adjustment is required as follows:

a. Turn slug T 003 slightly clockwise. Then tune in the signal for maximum amplitude, disconnect and reconnect the input signal and note if signal is captured.

b. If the signal is not recaptured, but seems closer to the recapture point, turn slug T 003 slightly more clockwise, retune for maximum, one more disconnect and reconnect the signal, and note if the signal is recaptured.

c. If the clockwise adjustments seem to be moving the signal further from the recapture point (more fine-tuning required to retune the signal), repeat the above procedure, turning discriminator transformer slug T 003 in a counter-clockwise direction.

d. Continue the trial and error adjustment until the signal is recaptured.

e. Since this adjustment depends on the receiver's noise level, and since this noise level and character varies from band-to-band, and for different frequency setting on one band, recapture may not be possible for all tuning control settings on all bands. Since the top band in each IF frequency range (Bands 7, 10, and 15) will be the most critical in tuning, these bands should be used for the discriminator adjustment. The tuning control should be about center band frequency range.

5.6 MECHANICAL ALIGNMENT

5.6.1 BOTTOM COVER REMOVAL

The bottom cover may be removed by removing the 40 retaining screws around the perimeter of the Main Compartment and slipping back

the cover to free it from the mounting slots. To replace the cover, reverse the process.

5.6.2 FRONT PANEL REMOVAL

1. Remove DWELL, SLIDEBACK, METER FUNCTION knobs on front panel.

2 Remove six screws that hold front panel in place.

3 Remove bottom cover of EMC-25.

4 Disconnect coax cable (front of I.G. to RF attenuator). Remove this cable completely.

5 Remove panel from unit.

5.6.3 RF TUNER COVER REMOVAL

To gain access to the RF Tuner the battery will have to be removed by loosening its 4-quarter-turn fasteners and lifting it out. After removing the battery, remove the 18 flat-head and three binder-head screws from the upper cover. The seven screws at the rear will have to be removed with either a stubby screwdriver or a right-angle screwdriver.

5.6.4 MOTOR MICROSWITCH ALIGNMENT

TURN OFF POWER

The microswitch located on the RF Tuner Assembly above the Detent Arm can be aligned by the following procedure:

a. Loosen the two alignment screws that attach the microswitch bracket to the RF Tuner Assembly.

b. Manually rotate turret until front panel window shows the scale halfway between bands.

c. Move the microswitch down until the switch just "clicks" on.

d. Tighten the attaching screws, test the switch by rotating the turret and listening for a "click" when the Detent Arm just moves out of and into the detent position.

e. Tests should also be made by using the Remote Band switch function described in Section III.

5.6.5 CYLINDRICAL SCALE-WINDOW ALIGNMENT, Refer to Fig. 5.3 (Page 5-4)

5.6.6. IMPULSE GENERATOR (CALIBRATOR A1A2) REMOVAL

1. Remove DWELL, SLIDEBACK, METER FUNCTION knobs on front panel.

2. Remove six screws that hold front panel in place.

3. Remove bottom cover of EMC-25.

4. Be sure to unplug AC power

5. Remove turret cover.

6. Disconnect rigid coax cables from rear of I.G. inside turret, and front of I.G. to RF attenuator. Remove this cable completely.

7. Remove panel from unit and set along side of unit. Make sure RF attenuator and coupling shaft are not tampered with during this operation.

8. Remove the 4 flathead screws from rear of I.G. inside turret.

9. Install new I.G. and invert procedure.

10. It may be necessary to recheck the calibration for EMC-25 internal calibration.

SECTION VI

REFERENCE DATA

6.1 GENERAL

6.1.1 This section contains information which will be helpful in signal tracing during instrument checkout and/or maintenance. Figure 6.1 is a schematic location guide followed by electrical drawings. These electrical drawings are presented, as near as possible, in the order of signal flow within the instrument.

6.1.2 As an example, to locate the schematic of the log detector, check the lower right-hand corner of the block titled log detector for the figure number (Figure 6.12).

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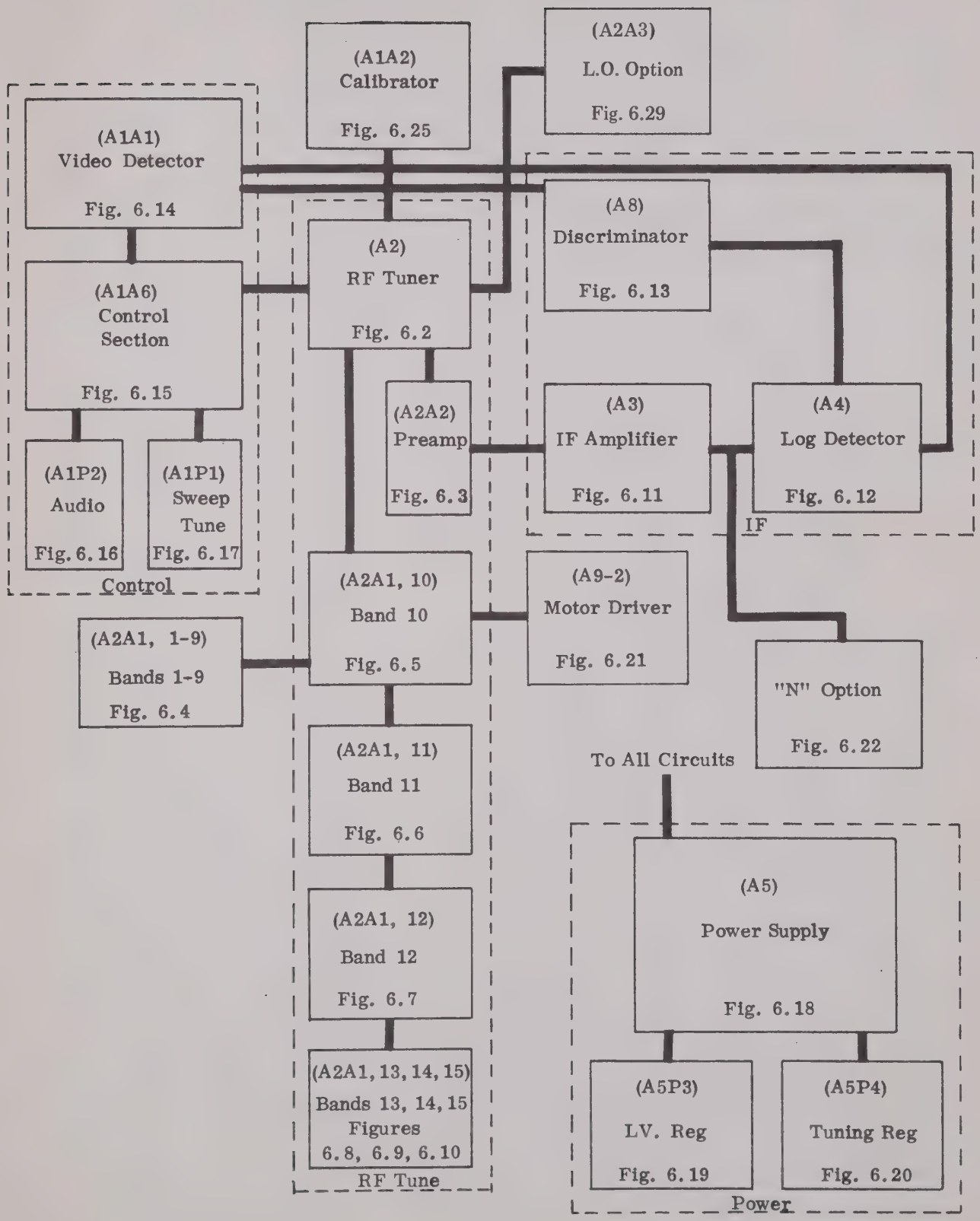


Figure 6.1 Schematic Location Guide

TABLE 6-1

REPLACEABLE MODULES, BOARDS AND ASSEMBLIES	
Description	**Nomenclature**
Power Supply, removable (Complete)	A5
Current Regulator, P.C. Bd	A5P2
Tuning Regulator, P.C. Bd	A5P4
Low Voltage P.C. Bd.	A5P3
High Voltage Converter Ass'y.	A5A1
Attenuator, RF Input	A1A3
Low Pass Filter, Input	A1A4
Audio Amplifier P.C. Bd.	A1P2
Sweep Tuning Board	A1P1
Video Detector	A1A1
Impulse Generator	A1A2
Battery	BAT-25
IF Amplifier Module	A3
Log Detector Module	A4
FM Discriminator Module	A8
Motor Assembly	A9
Stator Board	A2A1
Preamplifier Board	A2A2
Band 1, 10 kHz – 28.5 kHz	A2A1-1
Band 2, 28.5 kHz – 59.0 kHz	A2A1-2
Band 3, 59.0 kHz – 120 kHz	A2A1-3
Band 4, 120 kHz – 240 kHz	A2A1-4
Band 5, 240 kHz – .48 MHz	A2A1-5
Band 6, .48 MHz – 1.05 MHz	A2A1-6
Band 7, 1.05 MHz – 2.30 MHz	A2A1-7
Band 8, 2.30 MHz – 5.00 MHz	A2A1-8
Band 9, 5 MHz – 11 MHz	A2A1-9
Band 10, 11 MHz – 25 MHz	A2A1-10
Band 11, 25 MHz – 49 MHz	A2A1-11
Band 12, 49 MHz – 98 MHz	A2A1-12
Band 13, 98 MHz – 210 MHz	A2A1-13
Band 14, 210 MHz – 490 MHz	A2A1-14
Band 15, 490 MHz – 1000 MHz	A2A1-15
Set, internal, interchangeable cables with connectors	CS-25
Tuning Mechanism Assembly	3401
Harness (Set) EMC-25	H2
Meter (Front Panel)	A1M2
Dummy Plug	DP-252
Power Cable (AC)	PCD-25
Filter Bulkhead	A1FL1

TABLE 6-2

RECOMMENDED SPARE PARTS LIST
FOR
INTERFERENCE ANALYZERS MODEL EMC-25

Description	Recommended Quantity 1 set/10 sets		Part No.
Semiconductors	1	2	1N3064
Semiconductors	1	3	2N4416
Semiconductors	2	4	2N3690
Semiconductors	1	2	S15695
Semiconductors, matched pair	1	1	2N3563
Semiconductors	1	2	SP9657
Semiconductors	1	1	2N918
Semiconductors	1	3	S15649 or S15781 or 2N2484
Semiconductors	1	3	2N4249 or 2N4250 or S15695
Semiconductors	1	1	2N3053
Semiconductors	1	1	CK1114
Semiconductors, 47 PF	1	2	MC-105B or 646
Semiconductors	1	2	SE5020
Semiconductors	2	4	2N3693
Semiconductors	1	2	FD600
Semiconductors	1	2	2N3646
Semiconductors, matched pair	1	1	2N3690
Semiconductors	2	5	1N270
Semiconductors, matched pair	1	1	2N4065
Semiconductors, matched pair	1	1	2N3277
Semiconductors	1	1	SP8412A
Semiconductors	1	2	FD300
Semiconductors	1	1	2N3114
Semiconductors	1	1	2N3503
Semiconductors	1	2	2N1538 or 2N2137
Semiconductors	1	2	2N3054
Semiconductors	1	1	1N971B
Semiconductors	1	1	1N966B
Semiconductors	1	2	2N3273
Semiconductors	1	4	2A100

TABLE 6-2 (cont'd)

RECOMMENDED SPARE PARTS LIST
FOR
INTERFERENCE ANALYZERS MODEL EMC-25

Description	Recommended Quantity 1 set/10 sets		Part No.
Semiconductors	1	1	1N752
Semiconductors	1	4	CER69C
Semiconductors	1	1	1N756
Semiconductors	1	1	1N825A
Semiconductors	1	1	2N3440
Semiconductors	1	1	2N4888
Semiconductors	1	1	1N986B
Precision Resistor, 1.24K 1/8W 1%	0	1	RN60C
Precision Resistor, 2.05K 1/8W 1%	0	1	RN60C
Precision Resistor, 76.5K 1/8W 1%	0	1	RN60C
Precision Resistor, 76.6K 1/8W 1%	0	1	RN60C
Precision Resistor, 57.6K 1/8W 1%	0	1	RN60C
Precision Resistor, 35.7K 1/8W 1%	0	1	RN60C
Jack, Phone	0	1	111, A-1-05AX
Jack, Video	1	2	UG625/U
Jack, Female A1J5	1	1	SRE-50-S-J
Dummy Plug DP-252, A1P5	1	2	SRE-50-PJTCH-8
Cell, Battery	1	3	B3260
Circuit Breaker	1	2	MB315
Circuit Breaker, Battery	2	6	MB316
Connector, Power	1	1	MS3102 A14S-6P
Connector, Fanning Strip	0	1	11-160-CAL or 7-160 BAL
Connector, Male	0	1	27-9
Connector, Female	0	1	27-7
Crimp Tool for 27 Conn.	0	4	277-900
Cable, Battery with Connector (3128)	0	1	
Relay, Control, Motor Drive	1	2	842-0111-512-07
Relay, Clutch	0	1	FC130-101
Motor, Main Drive	1	2	3174
Step Switch	1	1	D-4242-1, 2
Straps, IF Hold Down	0	2	3453
Shaft Coupling	1	1	3086

TABLE 6-2 (cont'd)

RECOMMENDED SPARE PARTS LIST
FOR
INTERFERENCE ANALYZERS MODEL EMC-25

Description	Recommended Quantity 1 set/10 sets		Part No.
Bracket, Adapter	1	1	2273
Gasket 5'	1	1	1/8"
Assembly, Tuning Mech.	0	1	3401
22 pin connector PC Card	0	1	250-22-30-170
Transistor Socket, TO3	1	1	RTC-300T
Transistor Socket, TO	1	1	TRC-400T
Pin	1	1	3/u 3/4"
Set Screw .15	12	12	8/32
Cable, Coaxial	10'	10'	RG/174
Filter	1	1	C3330
Filter	1	1	C3140
Indicators	2	10	#44
Indicators	2	10	#47
Transformer	1	1	3215
Semiconductors	1	2	91428
Semiconductors	1	2	2N3638
Semiconductors, 235 PF	1	2	PQ1005
Choke, 1 MH	2	5	210.000M
Choke, 330 MH	2	5	43,400M
Choke, 10 MH	2	5	21000M
Pot, 2 K	1	1	200S1-202
Pot, 200 ohm	1	1	150-1
Pot, 5 K	1	1	100-1
Pot, 100K	1	2	GSIN 156 P104VA
Pot, 100K	1	2	GA2N156 P104VA
Pot, 2K	1	3	3067P1-202
Pot, 10K	1	2	7221 Helipot
Pot, 100K	1	3	JA3G048 P104UA
Pot, 10K	1	2	JA1G048 P103UA
Pot, 20K	1	1	30671P1-203
Pot, 500 ohm	1	1	3067P1-501
Pot, 500 K	1	1	3068P1-204
Capacitor, 2.2 MF	2	10	TSD-1-15-225

TABLE 6-2 (cont'd)

RECOMMENDED SPARE PARTS LIST
FOR
INTERFERENCE ANALYZERS MODEL EMC-25

Description	Recommended Quantity 1 set/10 sets		Part No.
Capacitor, .01 MF 100V Disc	2	10	TTD
Capacitor, 1000 PF Feed thru	1	3	FB-2B
Capacitor, 5-25 PF Trimmer	2	10	557000-COPO-39R
Capacitor, 7-25 PF Trimmer	2	10	538-002-93R
Capacitor, 2-8 PF Trimmer	2	4	538-011-89R
Capacitor, 1000 MF	2	10	FA5C
Capacitor, .15 MF	2	5	C280AA-1-D150K
Capacitor, 15 MF	2	5	CS-13
Capacitor, 50 MF	1	1	NLW-50-25
Capacitor, 300 MF 150V	1	1	BR300-150
Switch, 3 wafers	1	1	B3073-1,2,3
Switch	1	1	C3242
Switch, Push button	2	5	MSP-205R
Switch, Toggle	1	1	MST-205PA
Switch, Toggle	1	2	MST-205N
Switch, Rotary	1	1	B3246-1,2,3
Switch, Line	0	1	G326
Switch, Micro	1	3	E62 10.1A 250VAC
Crystal, 1.425 MHz	0	1	CR-18/U
Precision Resistor, 40.2 ohm 1/4W 1%	1	1	RN60D
Precision Resistor, 820 ohm 1/4W 2%	1	1	RG07
Precision Resistor, 180 ohm 1/4W 2%	1	1	RG07
Precision Resistor, 270 ohm 1/4W 2%	1	1	RG07
Precision Resistor, 1.5K 1/4W 1%	1	1	RN60D
Precision Resistor, 82.5K 1/8W 1%	0	1	RN60C
Precision Resistor, 97.6K 1/8W 1%	0	1	RN60C
Precision Resistor, 12.1K 1/8W 1%	0	1	RN60C
Precision Resistor, 2.94K 1/8W 1%	0	1	RN60C
Precision Resistor, 2.26K 1/8W 1%	0	1	RN60C

TABLE 6-3

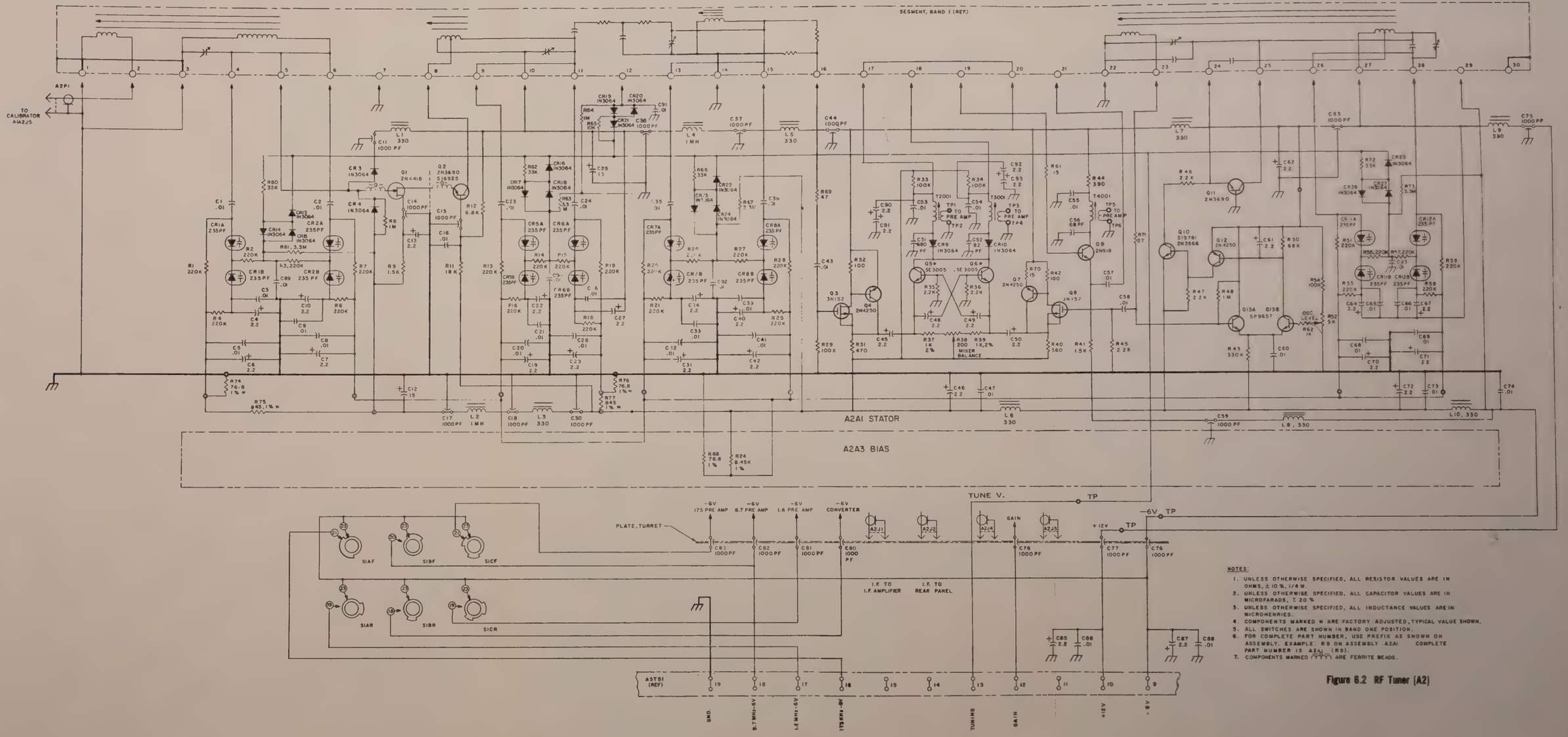
ACCESSORY LIST

Item	Description	Model
1	Interference Analyzer (including Battery Pack Model BAT-25, AC Power Cord Model PCD-25, instruction manual, Adapter Brackets Model ABM-25, coaxial cable Model CAC-25) 10 KHz to 1000 MHz	EMC-25
2	Instrument Carrying Case	ICC- 25
3	Remotely Switchable Loop Antenna, 10 KHz to 25 MHz	ALR-25
4	Remote Active Vertical 82" Antenna, 10 KHz to 25 MHz with Carrying Case	RVA-25
5	Remotely Switchable Vertical 41" Antenna, 10 KHz to 25 MHz	RVR-25
6	Broadband Dipole Antenna and Mount, 20 MHz to 200 MHz	BDA-25
7	Biconical Antenna, 20-200 MHz	BIA-25
8	Low Frequency Antenna Accessory Case (For transporting loop antenna, 41" Remote Antenna, Broadband Dipole and small accessories)	LVC-25
9	Log Conical Spiral Antenna, 200 MHz to 1000 MHz	LCA-25
10	Conical Antenna Carrying Case (For transporting LCA-25)	LCC-25
11	Clamp-on Probe, 10 KHz to 110 MHz (For maximum sensitivity 10 KHz to 11.5 MHz use PCL-10)	PCL-25
12	Magnetic Field Probe, 10 KHz to 520 KHz	MFA-25
13	Magnetic Field Probe, 480 KHz to 25 MHz	MFB-25
14	Magnetic Field Probe, 22 MHz to 230 MHz	MFC-25
15	Electro-Static Field Probe, 10 KHz to 1000 MHz	EFP-25
16	Counterpoise, 2' x 2' (for vertical antennas)	GPA-25
17	Carrying Cover with Handle	EAC-25
18	Earphones, speech	EEM-25
19	Earphones, high intelligibility	EHF-25
20	Attenuator, Voltage Extension (20 DB, 4 watts)	FA-504-20T
21	Remote Meter with 25 ft. cable	RIM-252
22	Coaxial Cable, 25 foot	CAC-25
23	Extra Adapter Brackets (pr. for 19" rack mounting)	ABM-25
24	Extra Alignment Tool Kit	ATK-25
25	Extra AC Power Cord	PCD-25
26	DC Power Cord	PDD-25
27	Tripod (Rugged) and Tripod Bag	TRP-25
28	Mast Sections (2)	MSA-25
29	Replacement Nickel Cadmium Battery Pack	BAT-25
30	Extra Instruction Manual	—
31	Tunable Rejection Filters	
	14 KHz — 220 KHz	TRF-11
	220 KHz — 3500 KHz	TRF-12
	3.5 MHz — 14 MHz	TRF-13
	14 MHz — 110 MHz	TRF-14
	110 MHz — 1000 MHz	TRF-15

TABLE 6-3 (cont'd)

ACCESSORY LIST

Item	Description	Model
32	Complete Set, Tunable Rejection Filters, 14 KHz – 1000 MHz	as above
33	Instrument Carrying Case (For one TRF filter)	ICC-15
34	Standard Accessory Kit, 10 KHz – 100 MHz, consisting of:	AAK-25A
	(1) Remotely Switchable Loop Antenna, 10 KHz – 25 MHz	ALR-25
	(2) Remotely Switchable Vertical 41" Antenna, 10 KHz – 25 MHz	RVR-25
	(3) Antenna Accessory Case	LVC-25
	(4) Broadband Dipole Antenna and Mount, 20 MHz – 200 MHz	BDA-25
	(5) Log Conical Spiral Antenna, 200 MHz to 1000 MHz	LCA-25
	(6) Conical Spiral Antenna Accessory Case	LCC-25
	(7) Coaxial Cable, 25 ft.	CAC-25
	(8) Clamp-on Probe, 10 KHz – 110 MHz	PCL-25
	(9) Magnetic Field Probe, 10 KHz – 520 KHz	MFA-25
	(10) Magnetic Field Probe, 480 KHz – 24 MHz	MFB-25
	(11) Magnetic Field Probe, 22 MHz – 230 MHz	MFC-25
	(12) Electro-Static Field Probe, 10 KHz to 1000 MHz	EFP-25
	(13) Tripod	TRP-25
	(14) Tripod Bag	TRB-25
	(15) Counterpoise, 2' x 2'	GPA-25
	(16) Control Junction Box	CJB-252
	(17) Instrument Carrying Case	ICC-25
	(18) Antenna Mount	AMT-25
	(19) Mast Section (2)	MSA-25
	(20) Antenna Control Cable	ACC-25B
35	Standard Accessory Kit, 10 kHz – 1 GHz, Contents same as AAK-25A except BIA-25 Biconical Antenna is substituted for the BDA-25 Dipole Antenna as required for MIL-STD-461 testing	AAK-25B
36	Electro-Scan Programmer for EMC-25R and EMC-10 with Antenna Switching Unit SU-125	ESC-125A
37	11" x 17" X-Y Plotter with choice of inter-connecting cable XYC-10 to EMC-10 or ESC-10A, or XYC-252 to EMC-25 or XYC-125 to ESC-125A	EXY-125B
38	11" x 17" Dual-Pen X-Y Plotter with interconnecting cable XYC-35 to ESC-125A	EXY-250C
39	Spectrum Analyzer Adapter including Oscilloscope, Time Base Plug-In and Plug-In Model PP-125	SPD-125
40	Spectrum Analyzer Plug-In (Plug-In Only)	PP-125
41	Extra X-Y Plotter Interconnecting Cable to EMC-25	XYC-252
42	Automated Spectrum Surveillance System including EMC-10, EMC-25, ESC-125A, EXY-125B and SPD-125 mounted together in 2-bay console, interconnected and tested as a system	FSS-250
43	Automated Spectrum Surveillance System including EMC-10, EMC-25, ESC-125A, EXY-250C and SPD-125 mounted together in 2-bay console, interconnected and tested as a system.	FSS-250D



NOTES:

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS, ± 10 %, 1/4 W.
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITOR VALUES ARE IN MICROFARADS, ± 20 %
3. UNLESS OTHERWISE SPECIFIED, ALL INDUCTANCE VALUES ARE IN MICROHENRIES.
4. COMPONENTS MARKED * ARE FACTORY ADJUSTED, TYPICAL VALUE SHOWN.
5. ALL SWITCHES ARE SHOWN IN BAND ONE POSITION.
6. FOR COMPLETE PART NUMBER, USE PREFIX AS SHOWN ON ASSEMBLY. EXAMPLE: R9 ON ASSEMBLY A2A1 COMPLETE PART NUMBER IS A2A1 R9.
7. COMPONENTS MARKED (FB) ARE FERRITE BEADS.

Figure 6.2 RF Tuner (A2)

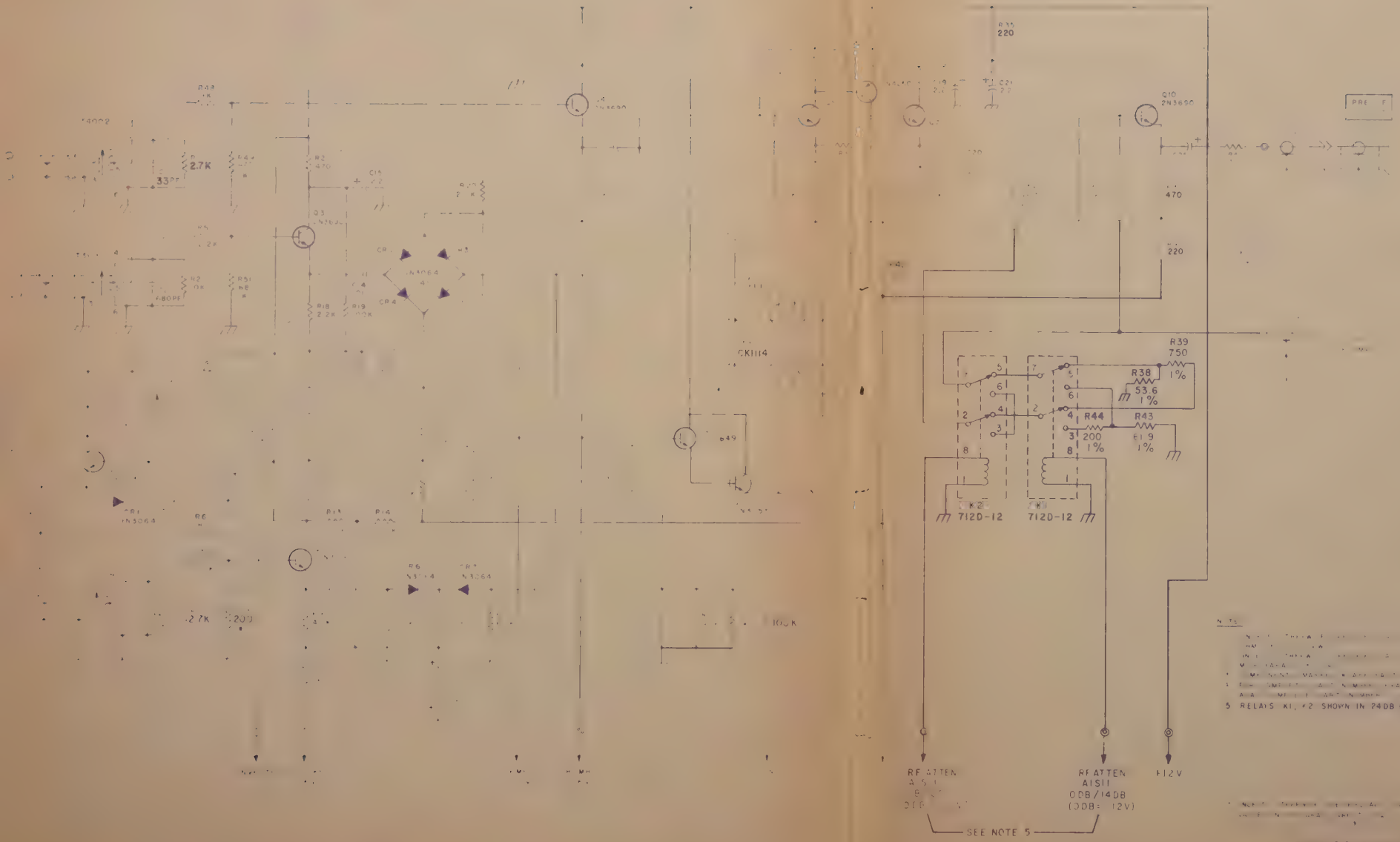
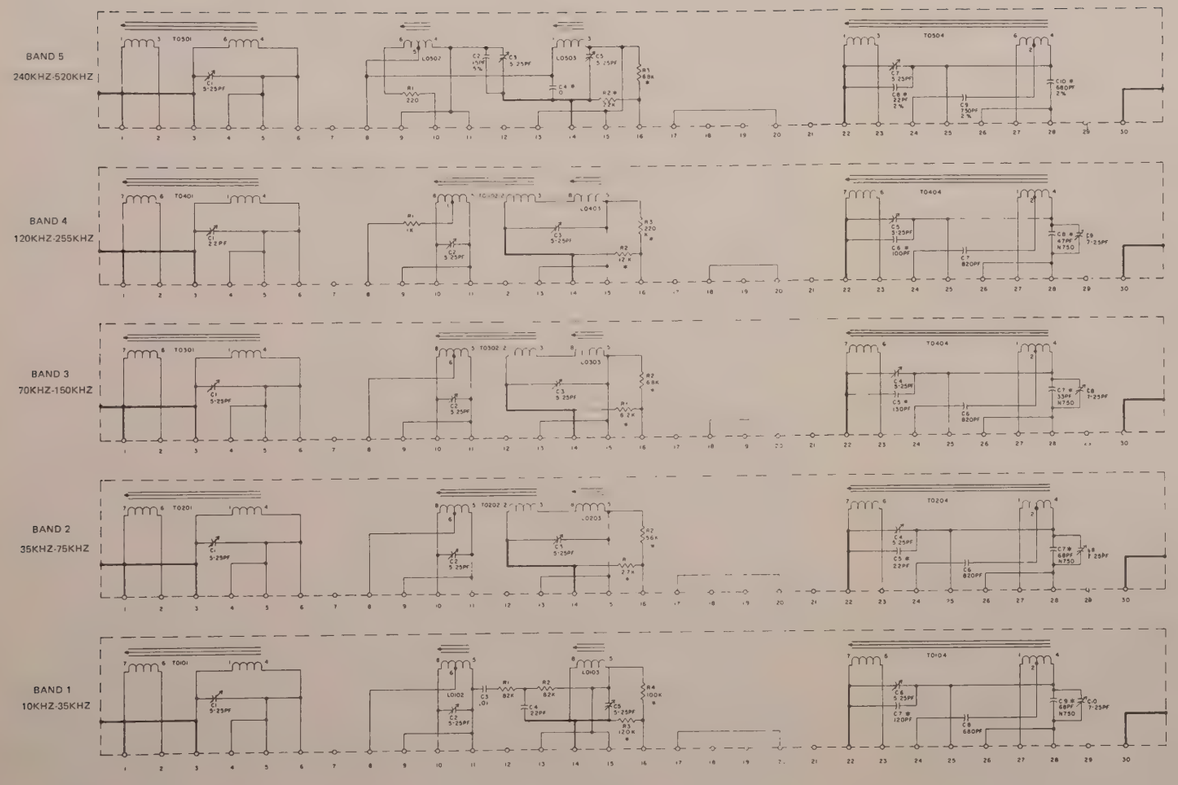
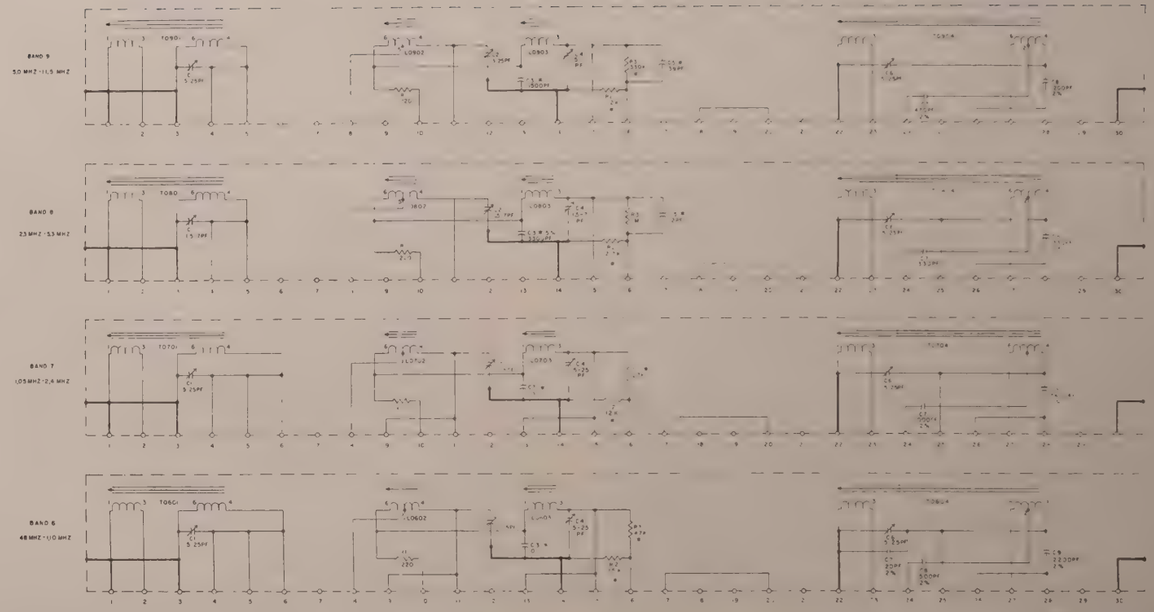


Figure 6.3 Preamp (A2A2)

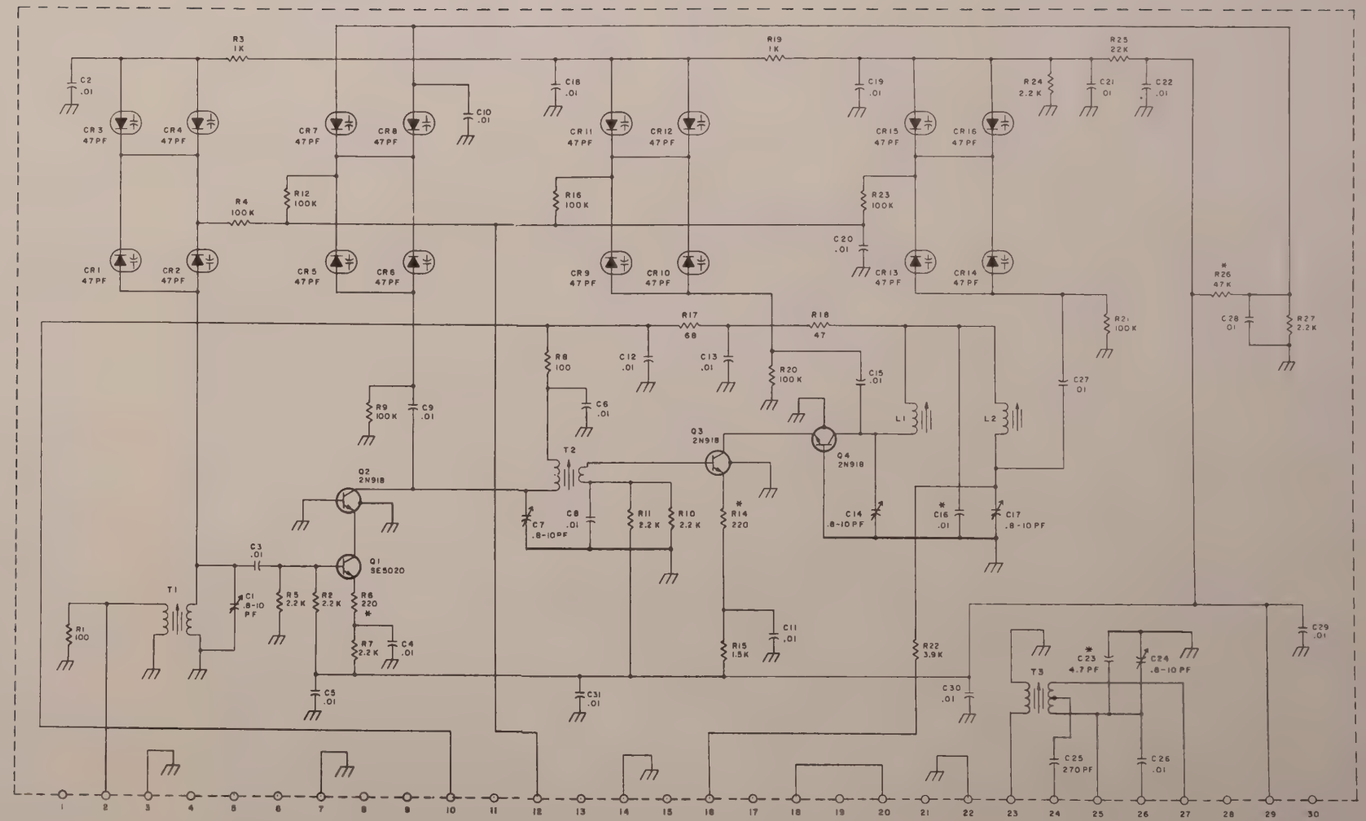




NOTES

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS, ±5%, 1/4W.
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITOR VALUES ARE IN MICROFARADS, ±20%.
3. UNLESS OTHERWISE SPECIFIED, ALL INDUCTANCE VALUES ARE IN MICROHENRIES.
4. COMPONENTS MARKED ⊕ ARE FACTORY ADJUSTED.
5. TYP VALUES SHOWN

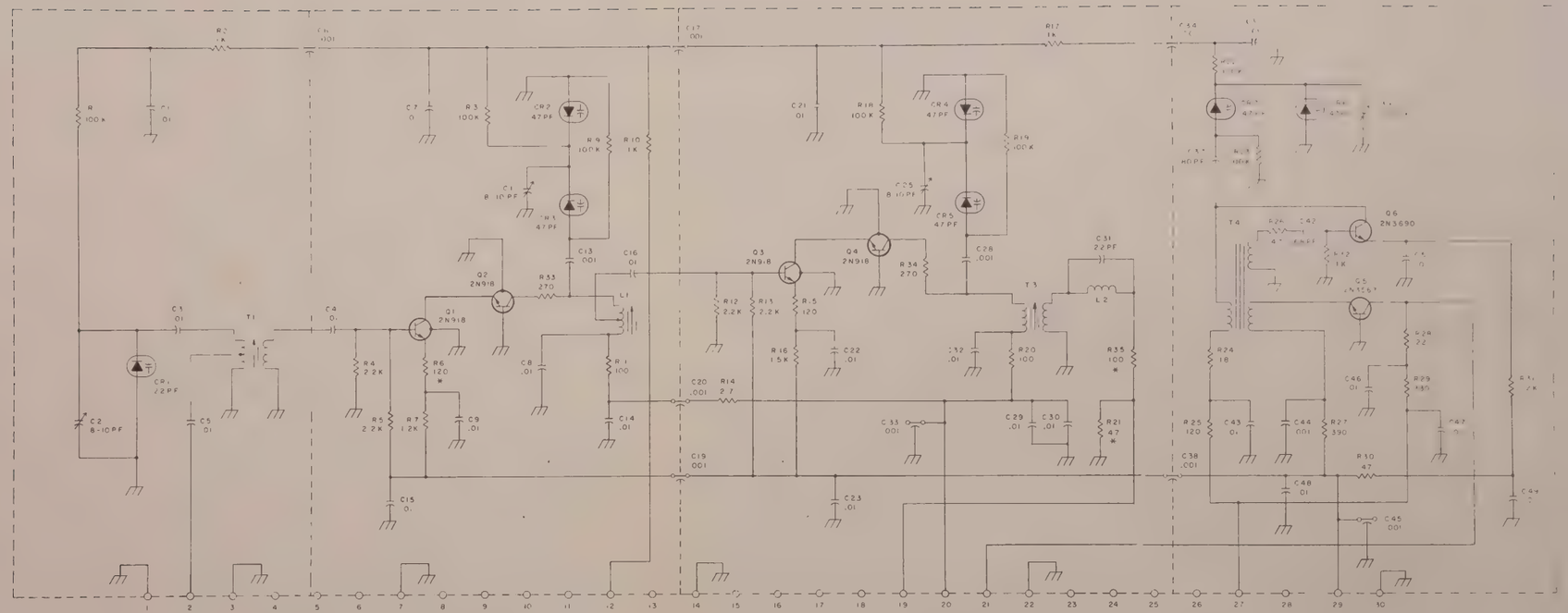
Figure 6.4 Band 1-9 (A2A1, 1-9)



NOTES

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS, ±10%, 1/4W
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITOR VALUES ARE IN MICROFARADS ±10%
3. UNLESS OTHERWISE SPECIFIED, ALL INDUCTANCE VALUES ARE IN MICROHENRIES ±10%
4. COMPONENTS MARKED * ARE FACTORY ADJUSTED TYPICAL VALUES SHOWN
5. FOR COMPLETE PART NUMBER USE PREFIX AS SHOWN ON ASSY EXAMPLE: R5 ON ASSY A2A1-10, COMPLETE PART NUMBER IS A2A1(R5).

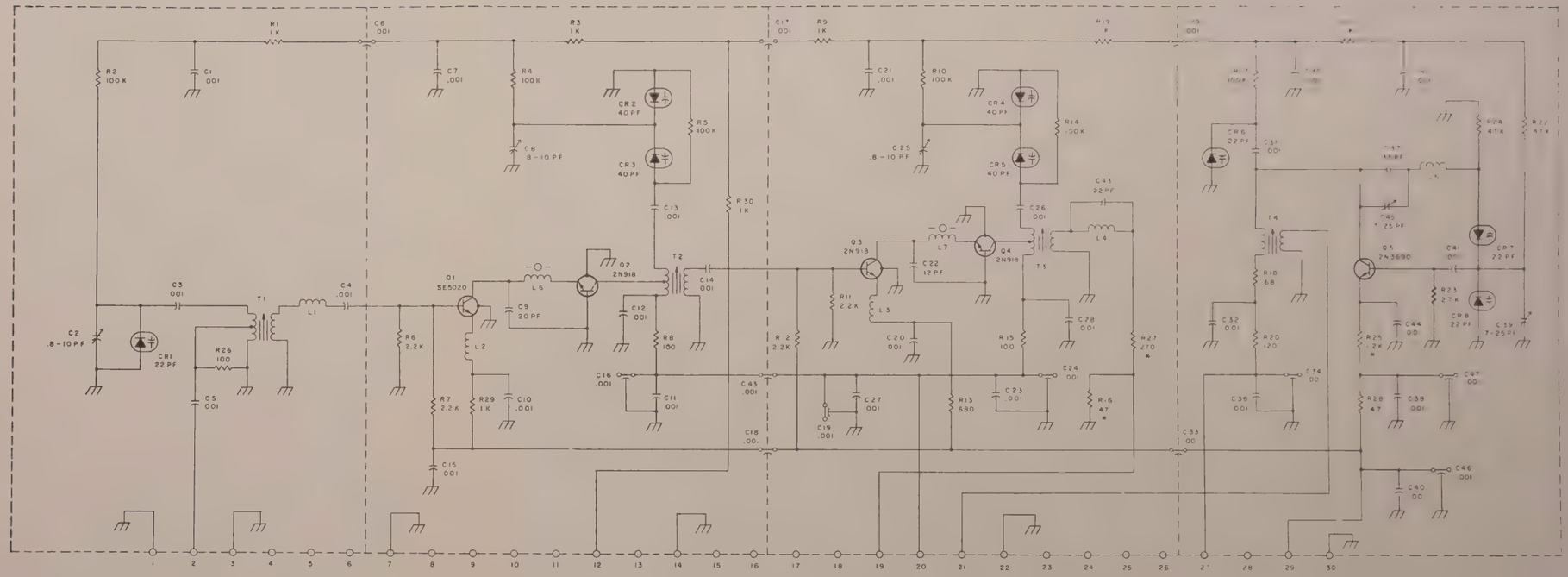
Figure 6.5 Band 10 (A2A1, 10)



NOTES

UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS, ±5%, 1/4W.
UNLESS OTHERWISE SPECIFIED, ALL CAPACITOR VALUES ARE IN MICROFARADS, ±10%.
UNLESS OTHERWISE SPECIFIED, ALL INDUCTANCE VALUES ARE IN MICROHENRIES, ±10%.
COMPONENTS MARKED * ARE FACTORY ADJUSTED AND MAY VARY.
FOR COMPLETE PART NUMBER USE PREFIX AS SHOWN ON ASSEMBLY DRAWING OR IN ANY CASE COMPLETE PART NUMBER IS A 20-DIGIT.

Figure 6.6 Band 11 (A2A1,11)



NOTES

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS ± 10%, 1/4 W
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITOR VALUES ARE IN MICROFARADS ± 10%
3. UNLESS OTHERWISE SPECIFIED, ALL INDUCTANCE VALUES ARE IN MICROHENRIES ± 10%
4. COMPONENTS MARKED * ARE FACTORY ADJUSTED, TYPICAL VALUES SHOWN
5. FOR COMPLETE PART NUMBER, USE PREFIX AS SHOWN ON ASSY. EXAMPLE R5 ON ASSY A1P2, COMPLETE PART NUMBER IS A1P2-1R51.
6. COMPONENTS MARKED ~O~ ARE FERRITE BEADS.

FIGURE 6.7 BAND 12 (A2A1,12)

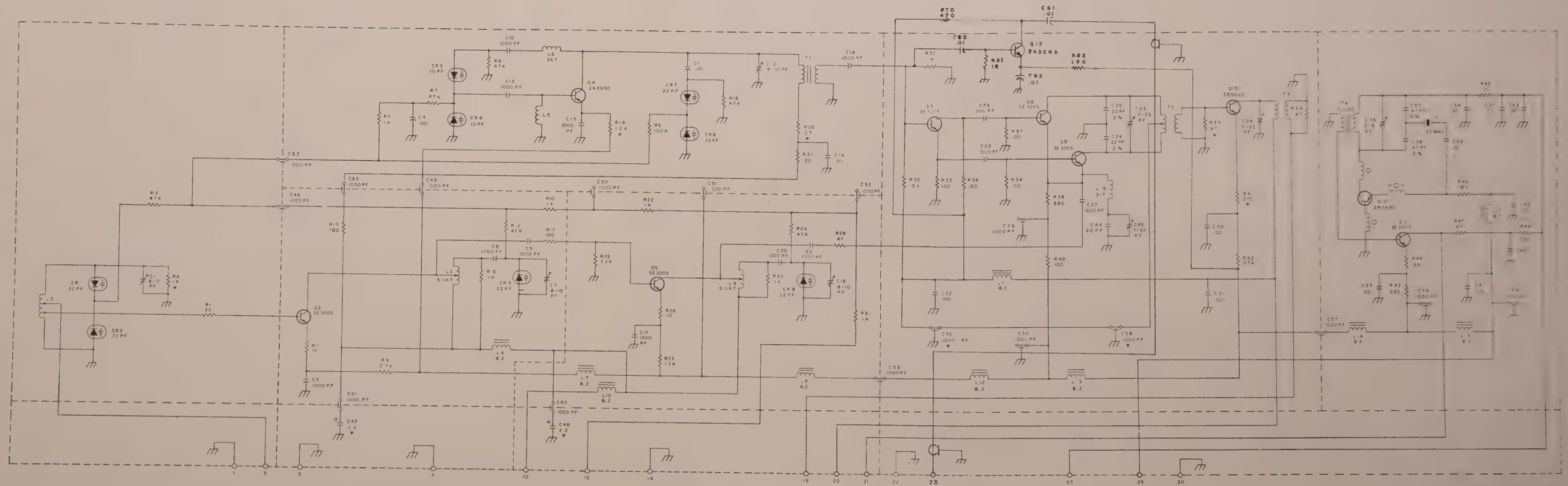
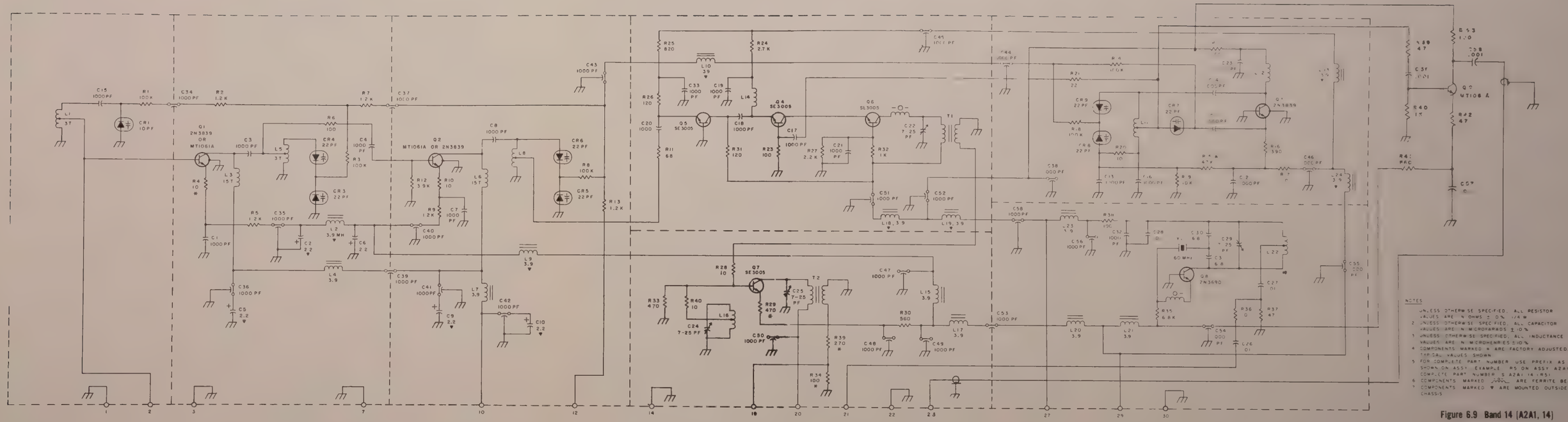


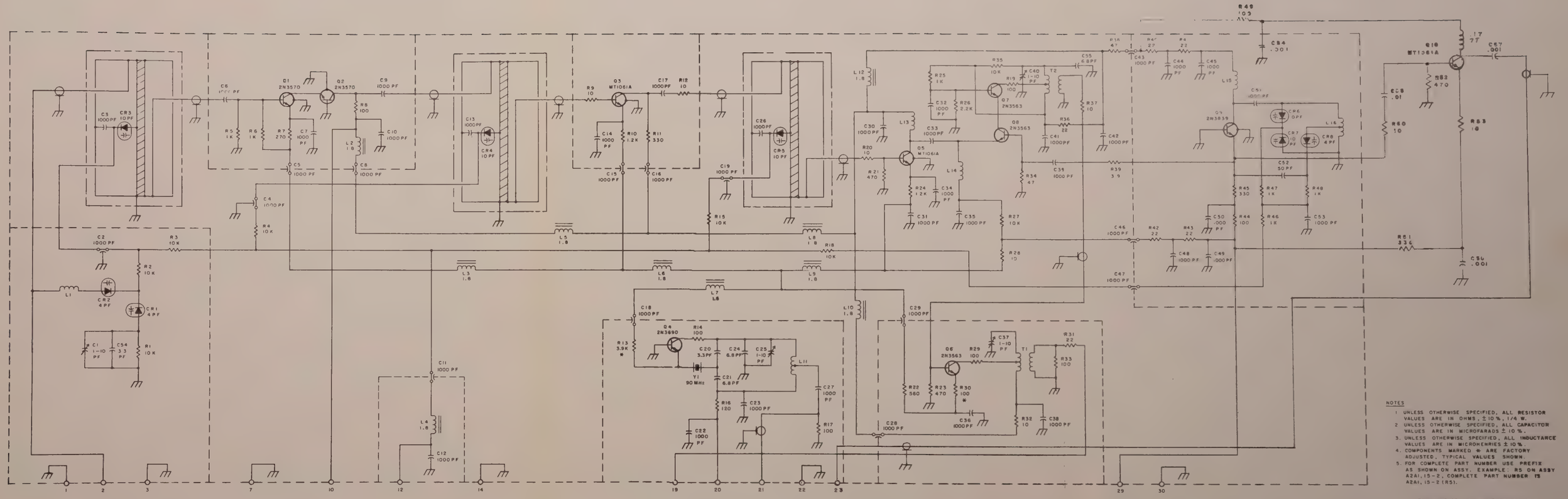
Figure 6.8 Band 13 (A2A1, 13)



NOTES

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS ± 0% 1/4 W
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITOR VALUES ARE IN MICROFARADS ± 10%
3. UNLESS OTHERWISE SPECIFIED, ALL INDUCTANCE VALUES ARE IN MICROHENRIES ± 10%
4. COMPONENTS MARKED * ARE FACTORY ADJUSTED, TYPICAL VALUES SHOWN
5. FOR COMPLETE PART NUMBER USE PREFIX AS SHOWN ON ASSY EXAMPLE R5 ON ASSY A2A1,14 COMPLETE PART NUMBER IS A2A1-14-R5
6. COMPONENTS MARKED ∠∞∞ ARE FERRITE BEADS.
7. COMPONENTS MARKED ▼ ARE MOUNTED OUTSIDE OF CHASSIS

Figure 6.9 Band 14 (A2A1, 14)



NOTES

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS, ±10%, 1/4 W.
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITOR VALUES ARE IN MICROFARADS ±10%.
3. UNLESS OTHERWISE SPECIFIED, ALL INDUCTANCE VALUES ARE IN MICROHENRIES ±10%.
4. COMPONENTS MARKED * ARE FACTORY ADJUSTED, TYPICAL VALUES SHOWN.
5. FOR COMPLETE PART NUMBER USE PREFIX AS SHOWN ON ASSY. EXAMPLE: R5 ON ASSY A2A1, 15-2, COMPLETE PART NUMBER IS A2A1, 15-2 (R5).

Figure 6.10 Band 15 (A2A1, 15)

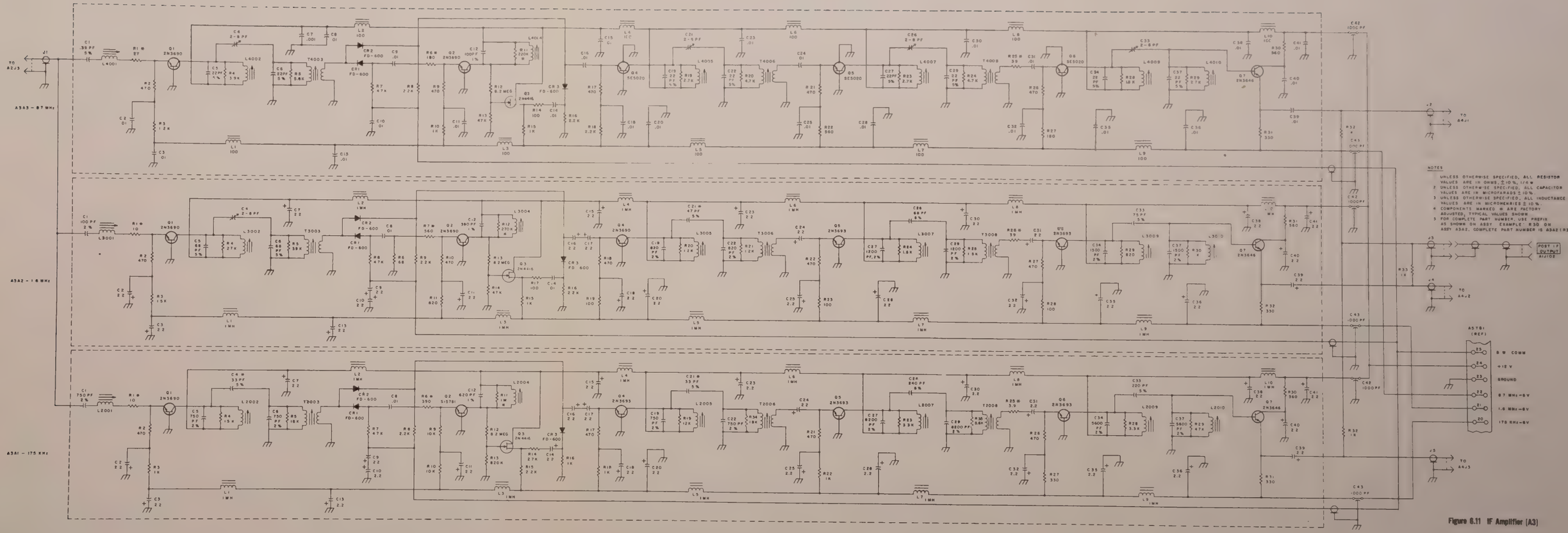

A3A3 – 87 MHz
A3A2 – 1.6 MHz
A3A1 – 175 KHz
NOTES
UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS, ±10%, 1/4 W
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITOR VALUES ARE IN MICROFARADS ±10%
3 UNLESS OTHERWISE SPECIFIED, ALL INDUCTANCE VALUES ARE IN MICROHENRIES ±10%
4 COMPONENTS MARKED * ARE FACTORY ADJUSTED, TYPICAL VALUES SHOWN
5 FOR COMPLETE PART NUMBER, USE PREFIX AS SHOWN ON ASSY EXAMPLE: R 50 ON ASSY A3A2, COMPLETE PART NUMBER IS A3A2(R50)
A5TB1 (REF)
8 W COMM
+18 V
GROUND
87 MHz-8V
1.6 MHz-8V
175 KHz-8V
POST I F OUTPUT AUDIO

Figure 6.11 IF Amplifier (A3)

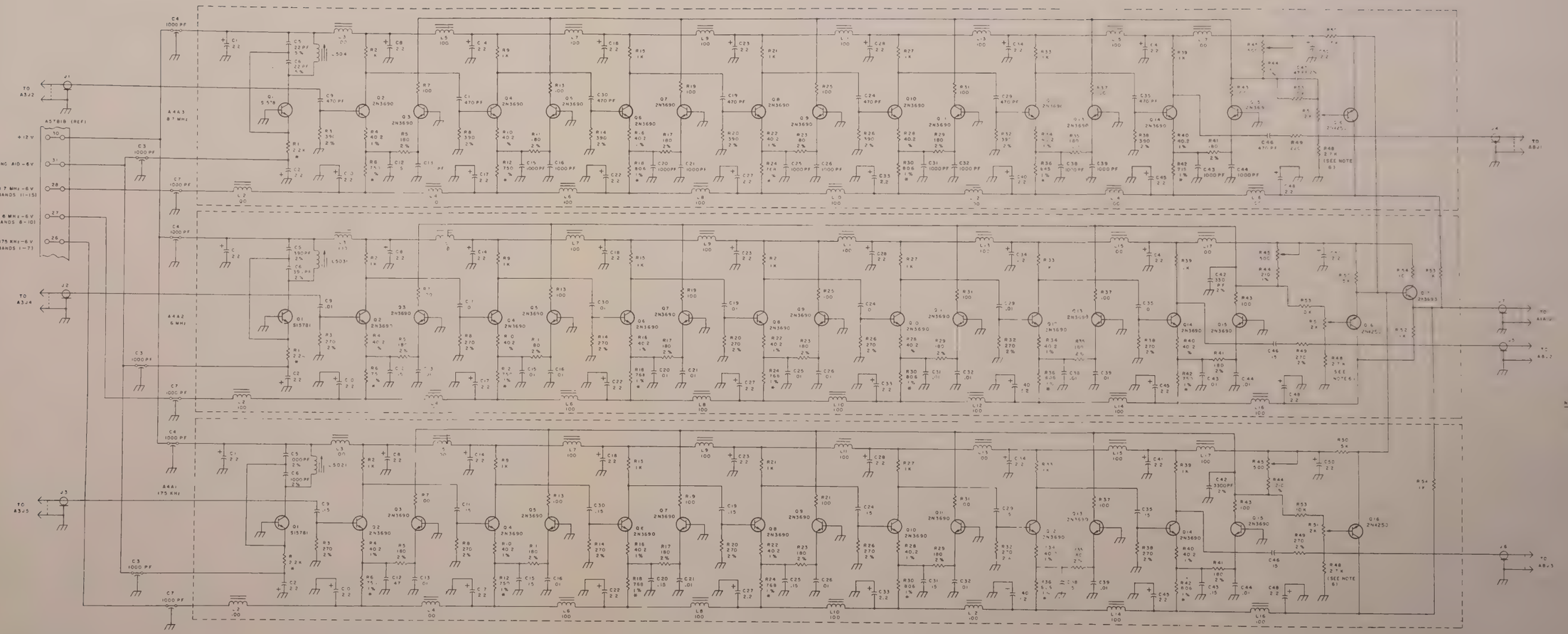
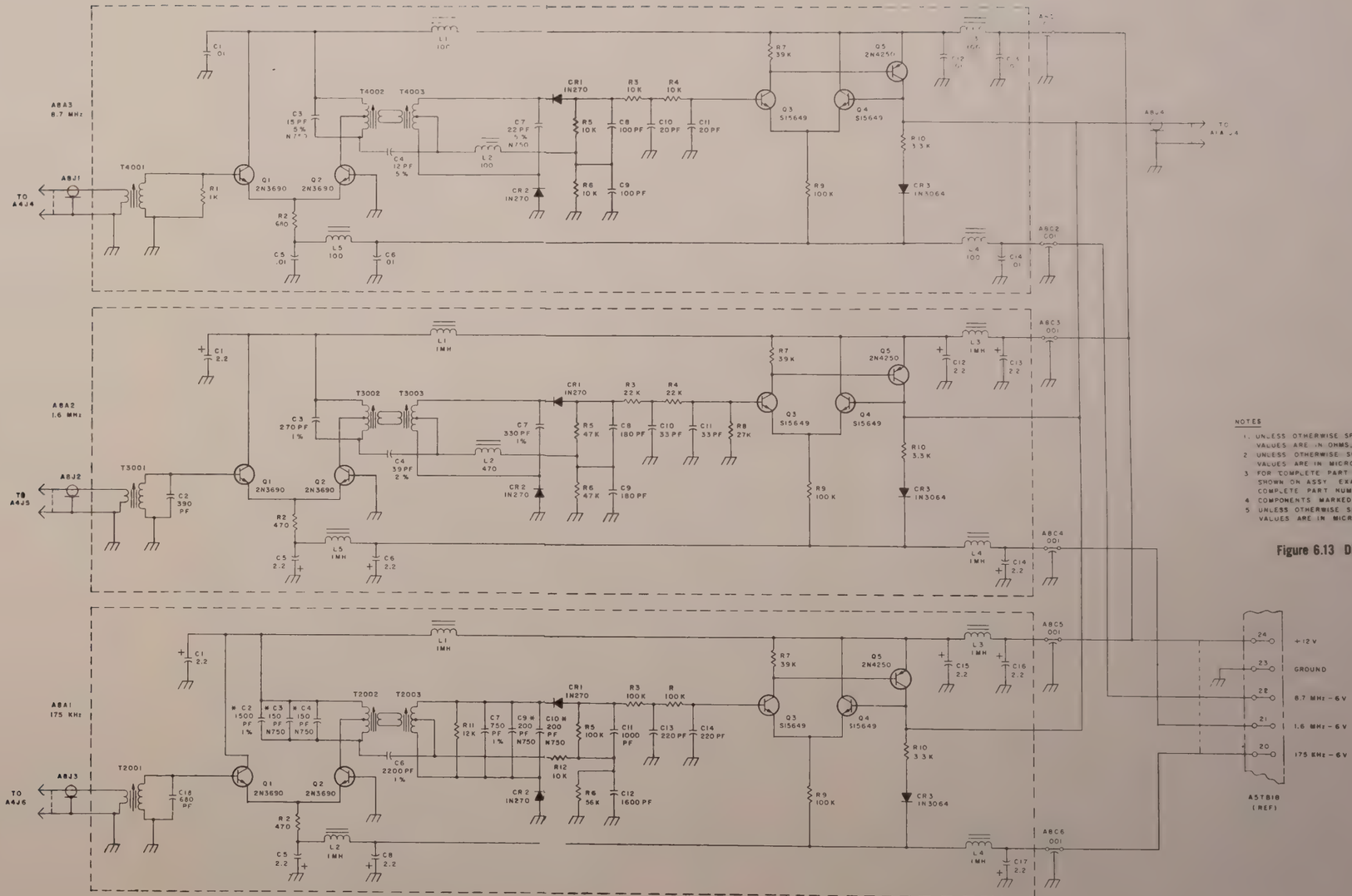


Figure 6.12 Log Detector (A4)



NOTES

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS, ±10%, 1/4 W.
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITOR VALUES ARE IN MICROFARADS ±10%.
3. FOR COMPLETE PART NUMBER, USE PREFIX A8 SHOWN ON ASSY. EXAMPLE: R5 ON ASSY A8, COMPLETE PART NUMBER A8 (R5).
4. COMPONENTS MARKED * ARE FACTORY ADJUSTED.
5. UNLESS OTHERWISE SPECIFIED, ALL INDUCTANCE VALUES ARE IN MICROHENRIES ± 10%.

Figure 6.13 Discriminator (A8)

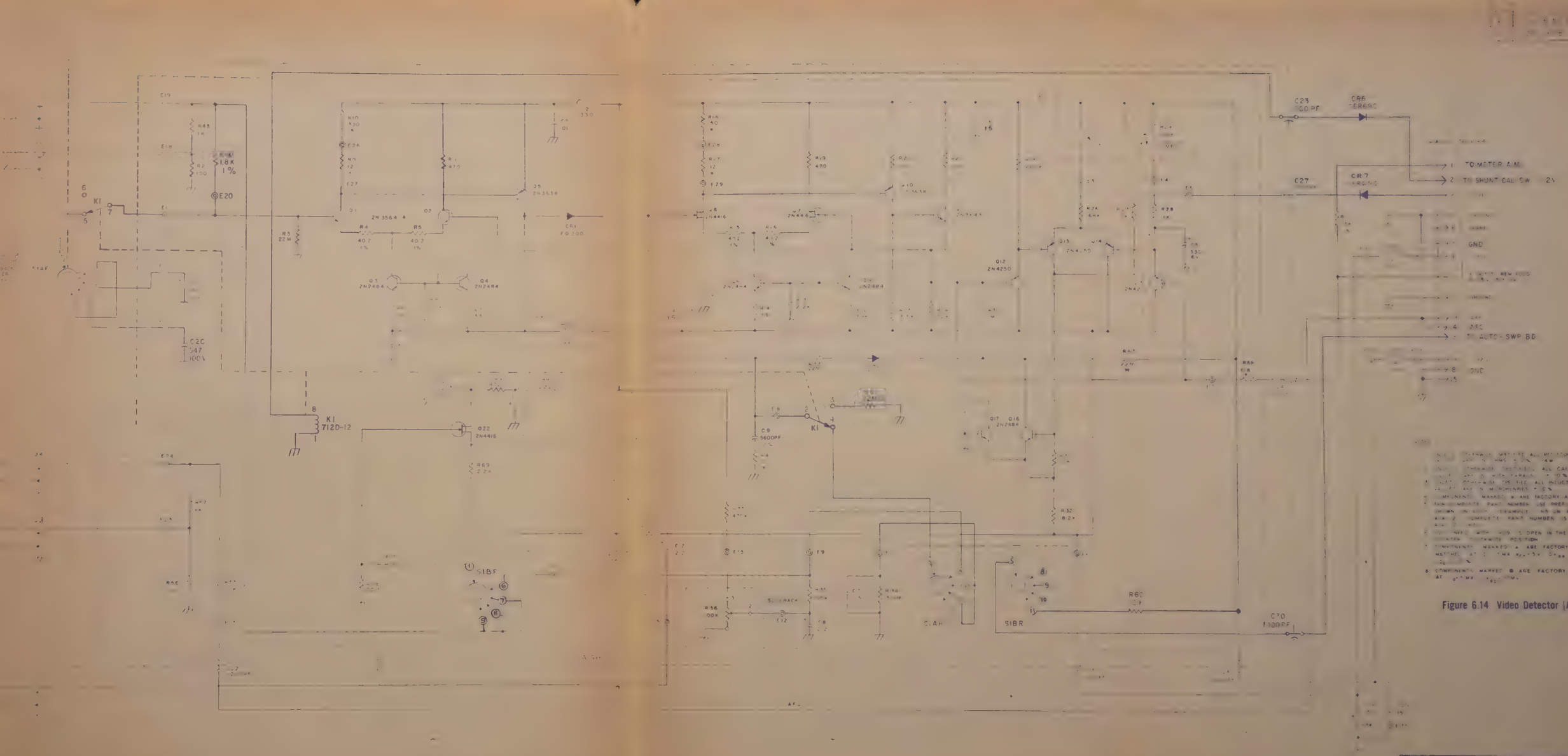
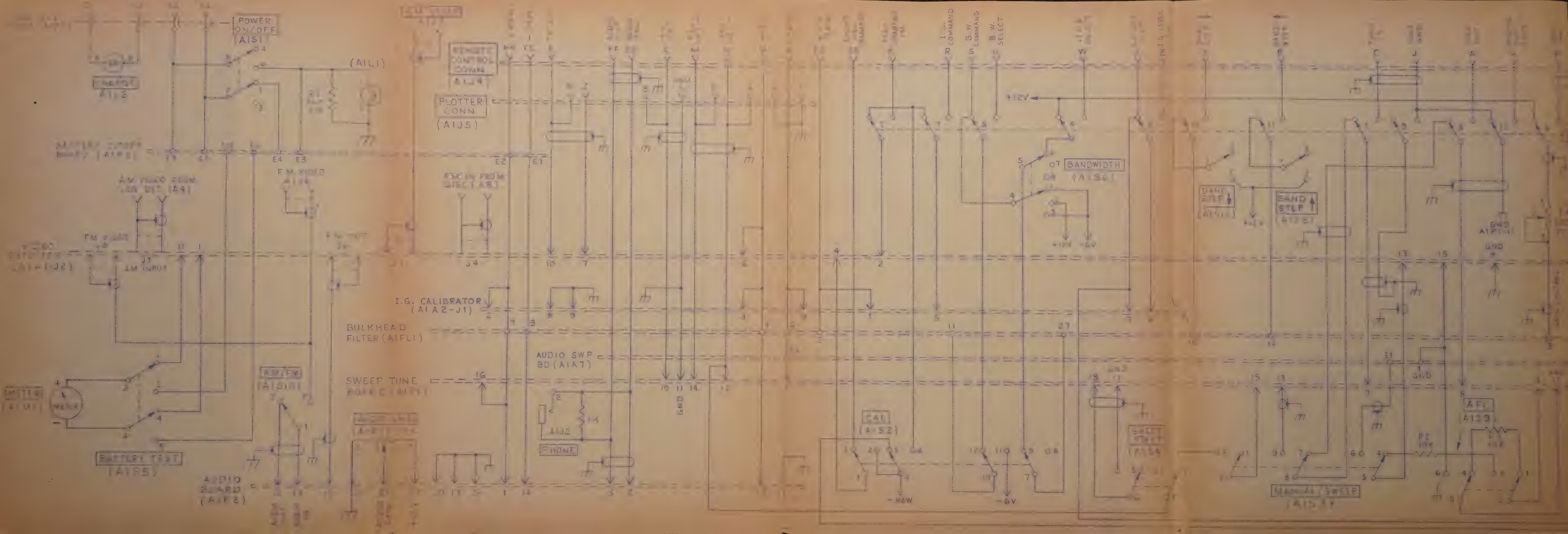
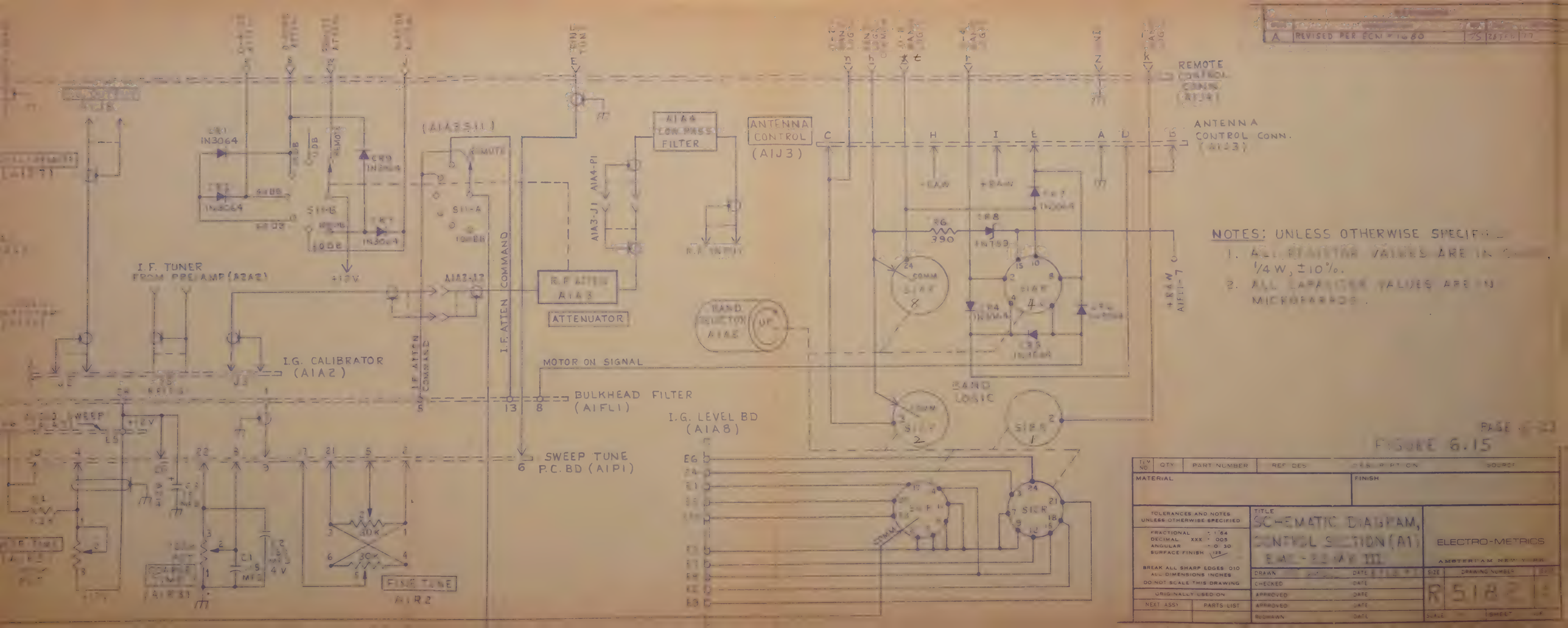


Figure 6.14 Video Detector (A1A1)


POWER ON/OFF (A1S1)
(A1L1)
REMOTE CONTROL CONN (A1J4)
PLOTTER CONN (A1J5)
A.M. VIDEO FROM LOG DET. (A4)
F.M. VIDEO (A1J4)
FM INPUT
AM INPUT
I.F. CALIBRATOR (A1A2-J1)
BULKHEAD FILTER (A1FL1)
AUDIO SWP BD (A1A7)
SWEEP TUNE (A1J1)
PHONE
AM/FM (A1S1A)
BATTERY TEST (A1S5)
AUDIO BOARD (A1P2)
BANDWIDTH (A1S6)
CAL (A1S2)
SWEEP STRUT (A1S4)
BAND STEP (A1S7)
MAN-AT SWEEP (A1S8)
AFL (A1S3)
+12V
-6V
GND



NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL RESISTOR VALUES ARE IN OHMS, 1/4 W, ±10%.
2. ALL CAPACITOR VALUES ARE IN MICROFARADS.

REV	DESCRIPTION	BY	DATE	APP'D
A	REVISED PER ECN #1080	JS	2/8/71	

FIGURE 6.15

PAGE

ITEM NO	QTY	PART NUMBER	REF DES	DESCRIPTION	SOURCE

MATERIAL

FINISH

TOLERANCES AND NOTES UNLESS OTHERWISE SPECIFIED

FRACTIONAL ± 1/64
DECIMAL XXX ± .005
ANGULAR ± 0° 30'
SURFACE FINISH 125

BREAK ALL SHARP EDGES .010
ALL DIMENSIONS INCHES
DO NOT SCALE THIS DRAWING

ORIGINALLY USED ON

NEXT ASSY | PARTS LIST

TITLE: SCHEMATIC DIAGRAM, CONTROL SECTION (A1) EMC-12 AM III

ELECTRO-METRICS
AMSTERDAM, NEW YORK

DRAWN		DATE 8/18/71
CHECKED		DATE
APPROVED		DATE
APPROVED		DATE
REDRAWN		DATE

SIZE | DRAWING NUMBER | REV
R 51821 | A

SCALE | SHEET

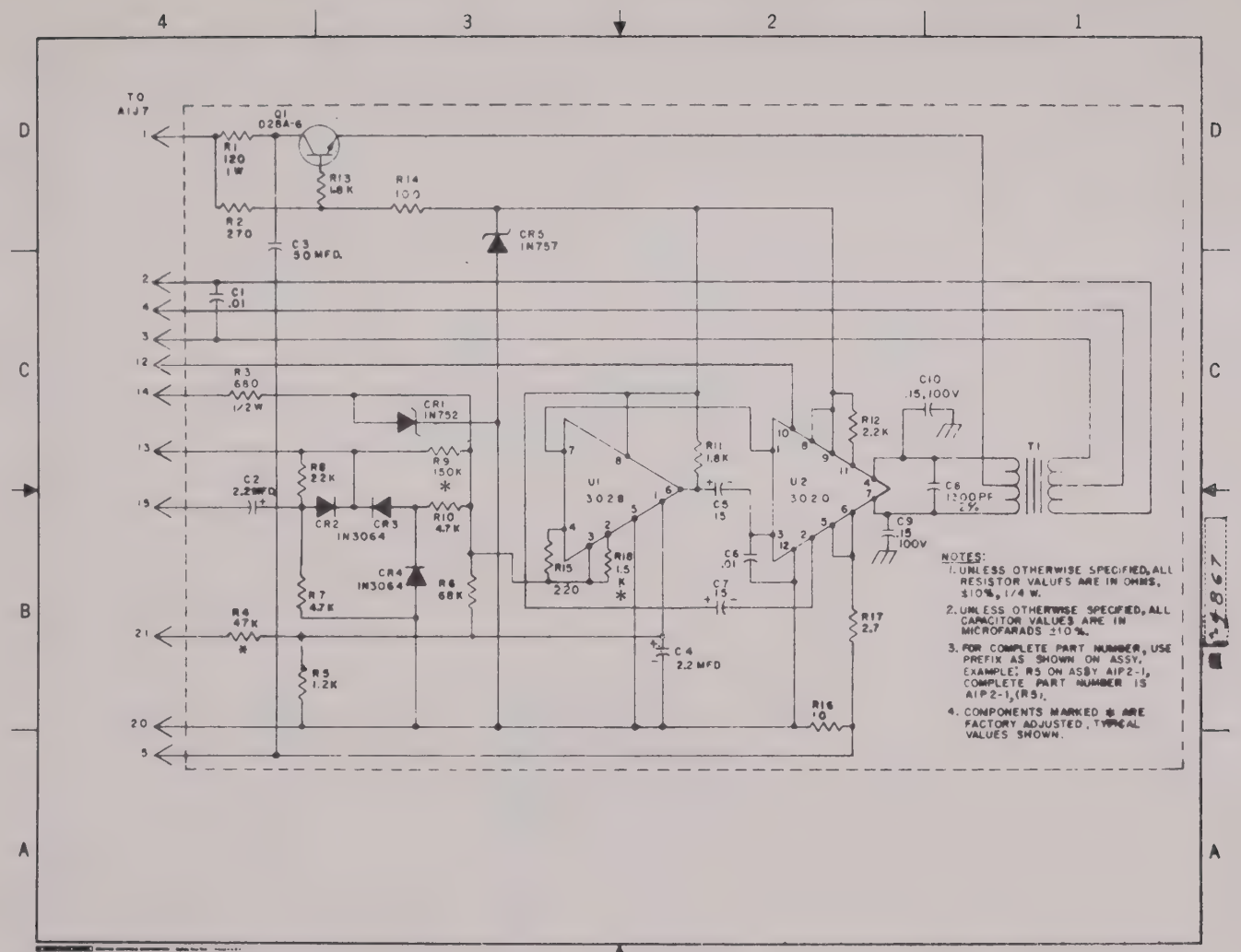
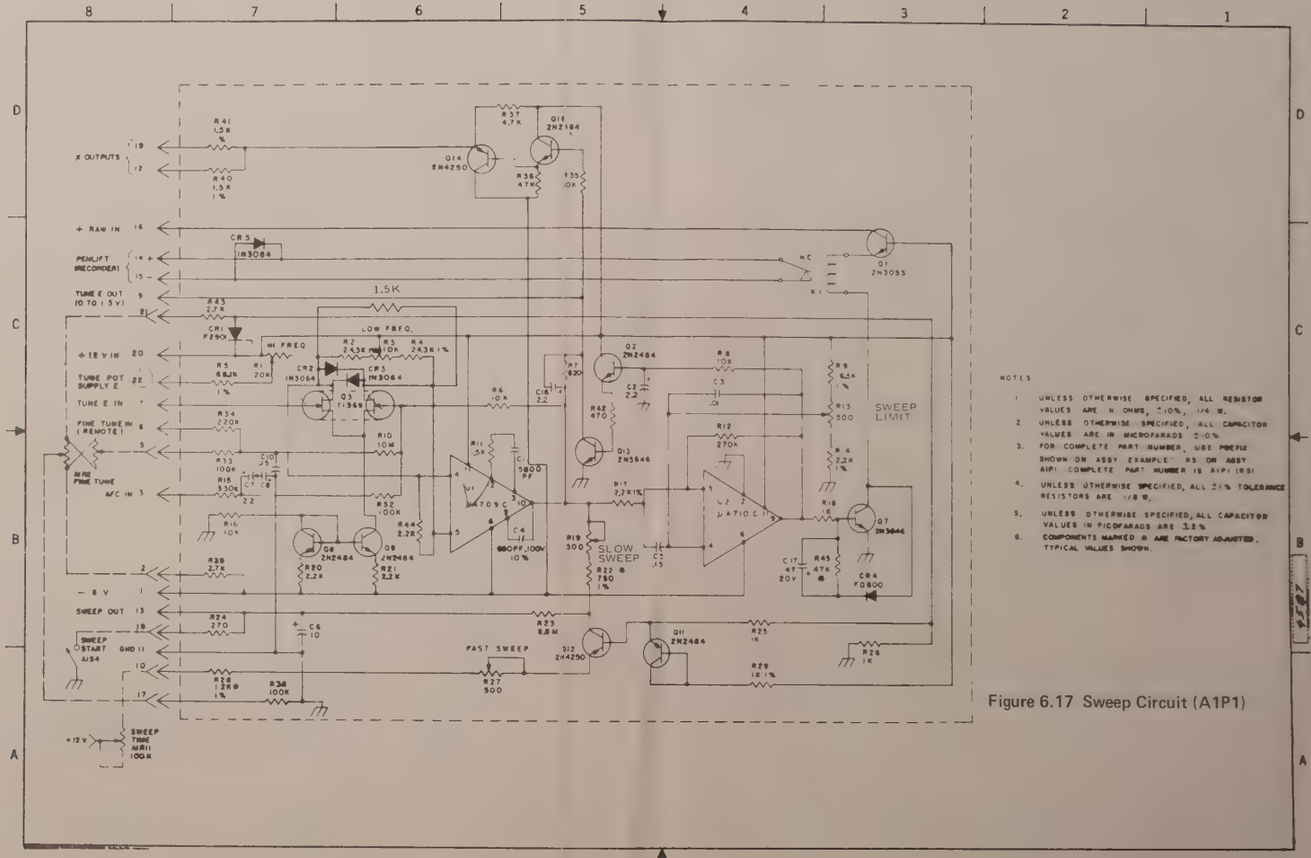


Figure 6.16 Audio Circuit (A1P2)



NOTES

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS, ±10%, 1/4 W.
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITOR VALUES ARE IN MICROFARADS ±10%
3. FOR COMPLETE PART NUMBER, USE PREFIX SHOWN ON ASSY EXAMPLE: R5 ON ASSY A1P1 COMPLETE PART NUMBER IS A1P1 (R5)
4. UNLESS OTHERWISE SPECIFIED, ALL ±1% TOLERANCE RESISTORS ARE 1/8 W.
5. UNLESS OTHERWISE SPECIFIED, ALL CAPACITOR VALUES IN PICOFARADS ARE ±2%
6. COMPONENTS MARKED ⊕ ARE FACTORY ADJUSTED. TYPICAL VALUES SHOWN.

Figure 6.17 Sweep Circuit (A1P1)

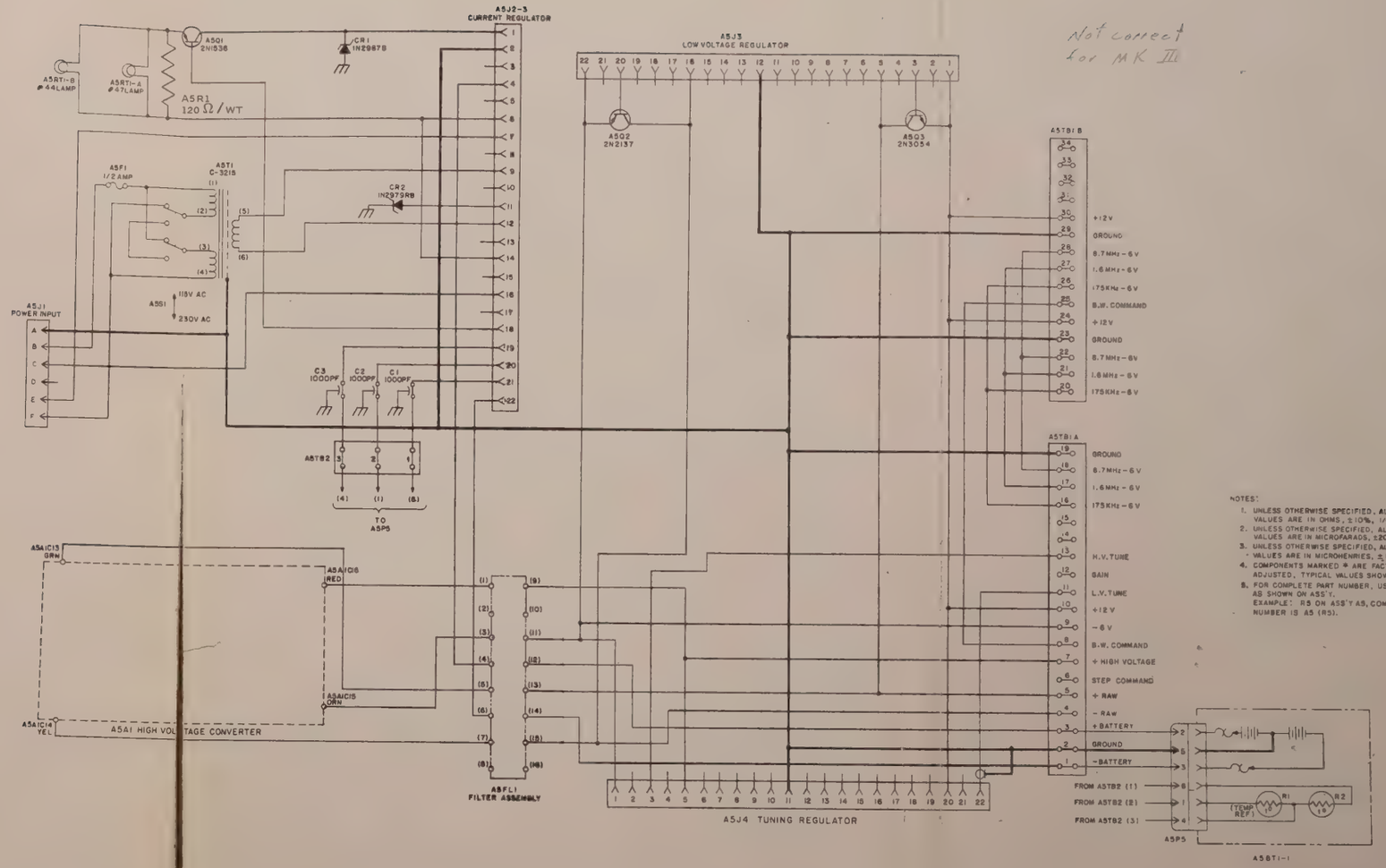
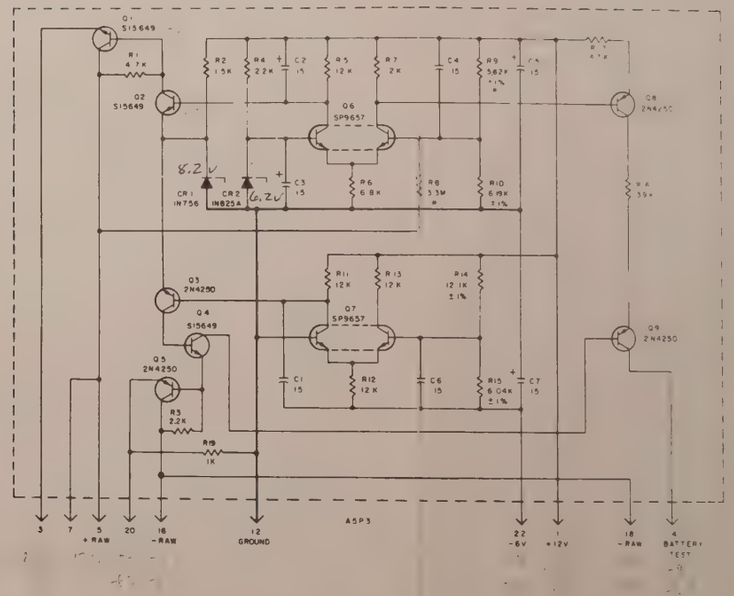


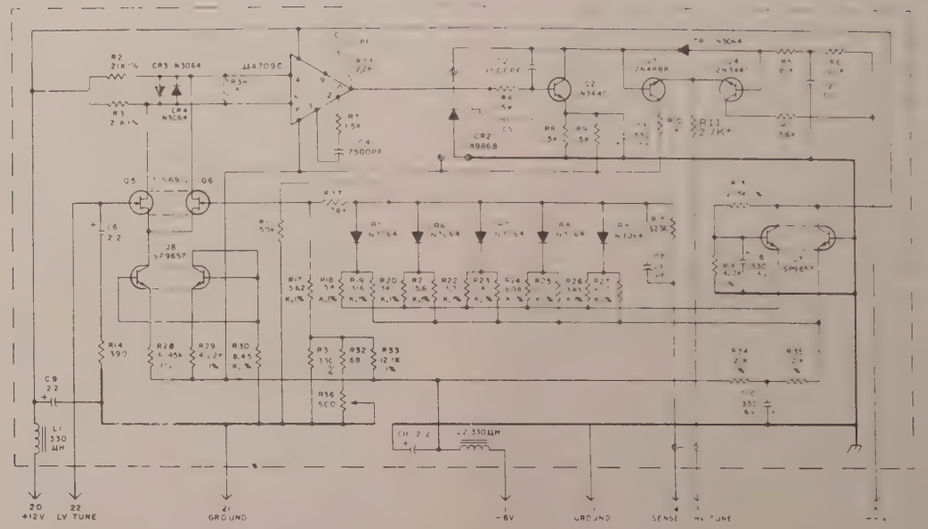
Figure 8.18 POWER SUPPLY (A5)



NOTES

1. UNLESS OTHERWISE SPECIFIED ALL RESISTOR VALUES ARE IN OHMS, ±5% ¼W
2. UNLESS OTHERWISE SPECIFIED ALL CAPACITOR VALUES ARE IN MICROFARADS, ±10%
3. FOR COMPLETE PART NUMBER, USE PREFIX SHOWN ON ASSY. EXAMPLE: R5 ON ASSY. A5P3 COMPLETE PART NUMBER IS A5P3 R51
4. COMPONENTS MARKED ✱ ARE FACTORY ADJUSTED; TYPICAL VALUES SHOWN

Figure 6.19 Low Voltage Regulator (A5P3)



NOTES

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS, ±10%, 1/4 W.
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITOR VALUES ARE IN MICROFARADS, ±10%.
3. UNLESS OTHERWISE SPECIFIED, ALL INDUCTANCE VALUES ARE IN MICROHENRIES, ±10%.
4. COMPONENTS MARKED * ARE FACTORY ADJUSTED. TYPICAL VALUES SHOWN.
5. FOR COMPLETE PART NUMBER USE PREFIX AS SHOWN ON ASSY. EXAMPLE: R5 IN ASSY A5P4 COMPLETE PART NUMBER IS A5P4-R5.
6. Q3-5 NOT INSTALLED ON ALL ASSEMBLIES.
7. CR2 IN 9868 IS SELECT KEY CONNECTED AS SHOWN.
8. Δ DENOTES FACTORY MATCHED PAIR (TEXAS INSTRUMENT)

Figure 6.20 Tuning Regulator (A5P4)

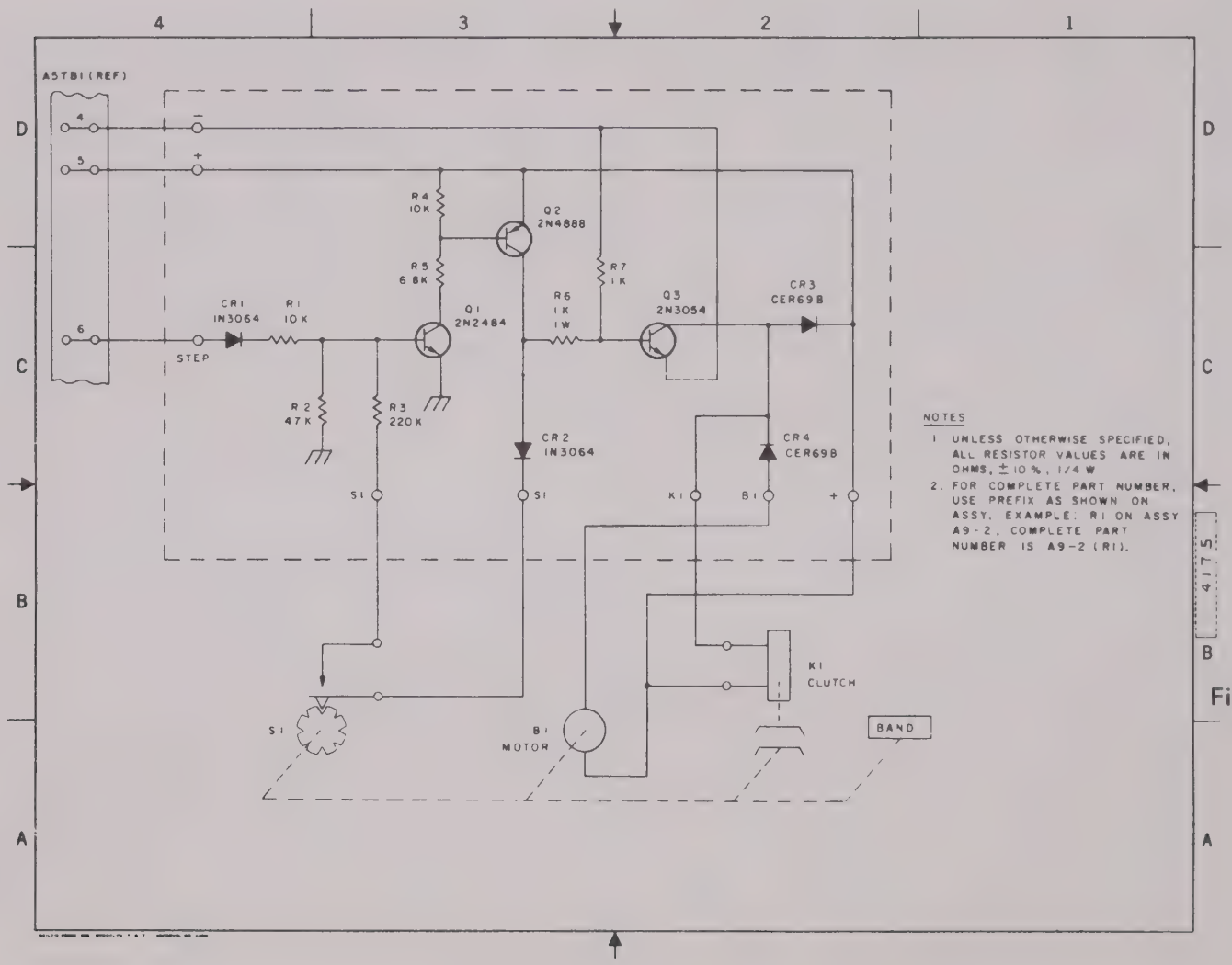


Figure 6.21 Motor Driver (A9-2)

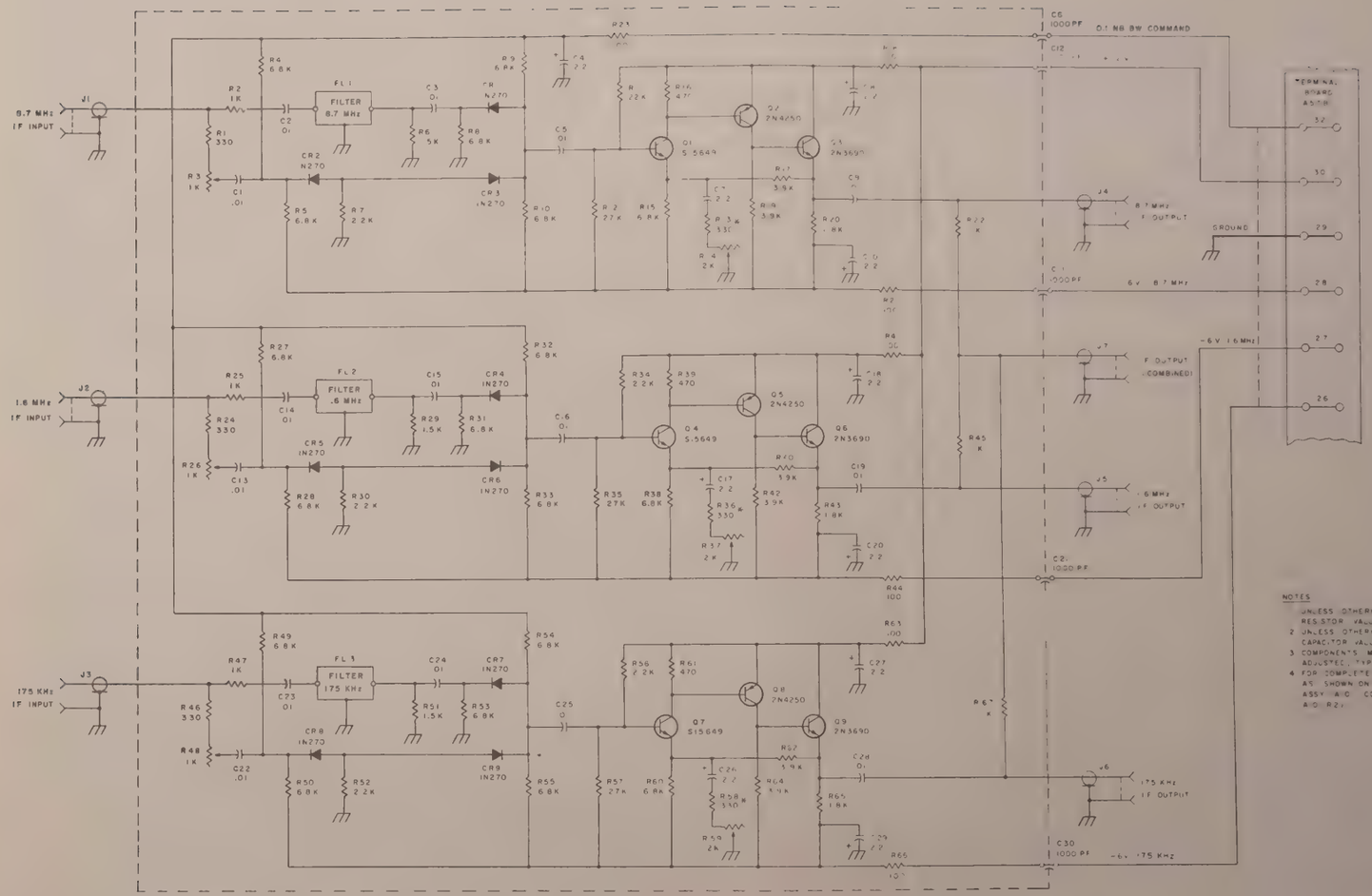
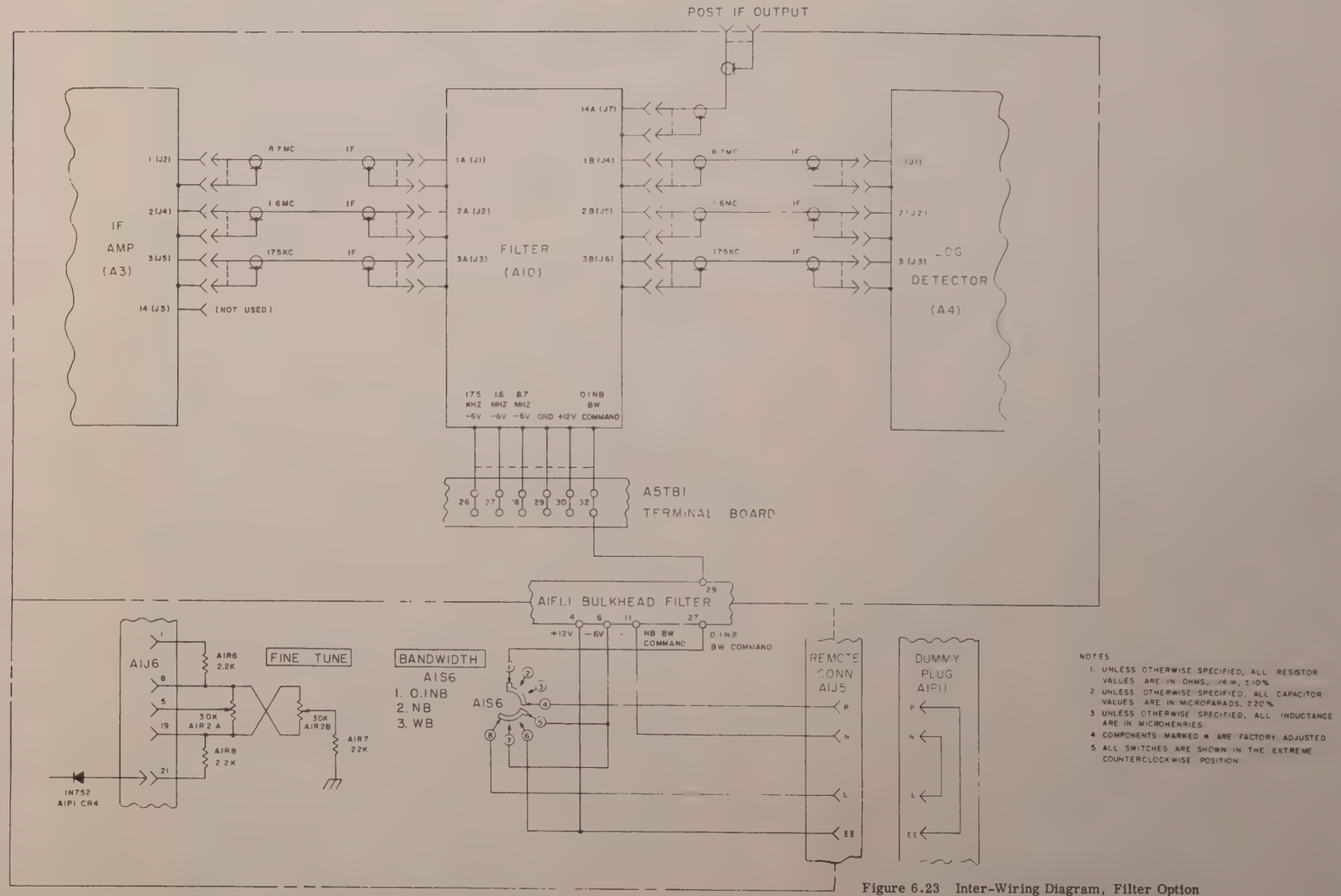


Figure 6-22 N FILTER OPTION (A 10)



NOTES

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS, 1/4 W, ±10%
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITOR VALUES ARE IN MICROFARADS, ±20%
3. UNLESS OTHERWISE SPECIFIED, ALL INDUCTANCE ARE IN MICROHENRIES
4. COMPONENTS MARKED * ARE FACTORY ADJUSTED
5. ALL SWITCHES ARE SHOWN IN THE EXTREME COUNTERCLOCKWISE POSITION

Figure 6.23 Inter-Wiring Diagram, Filter Option

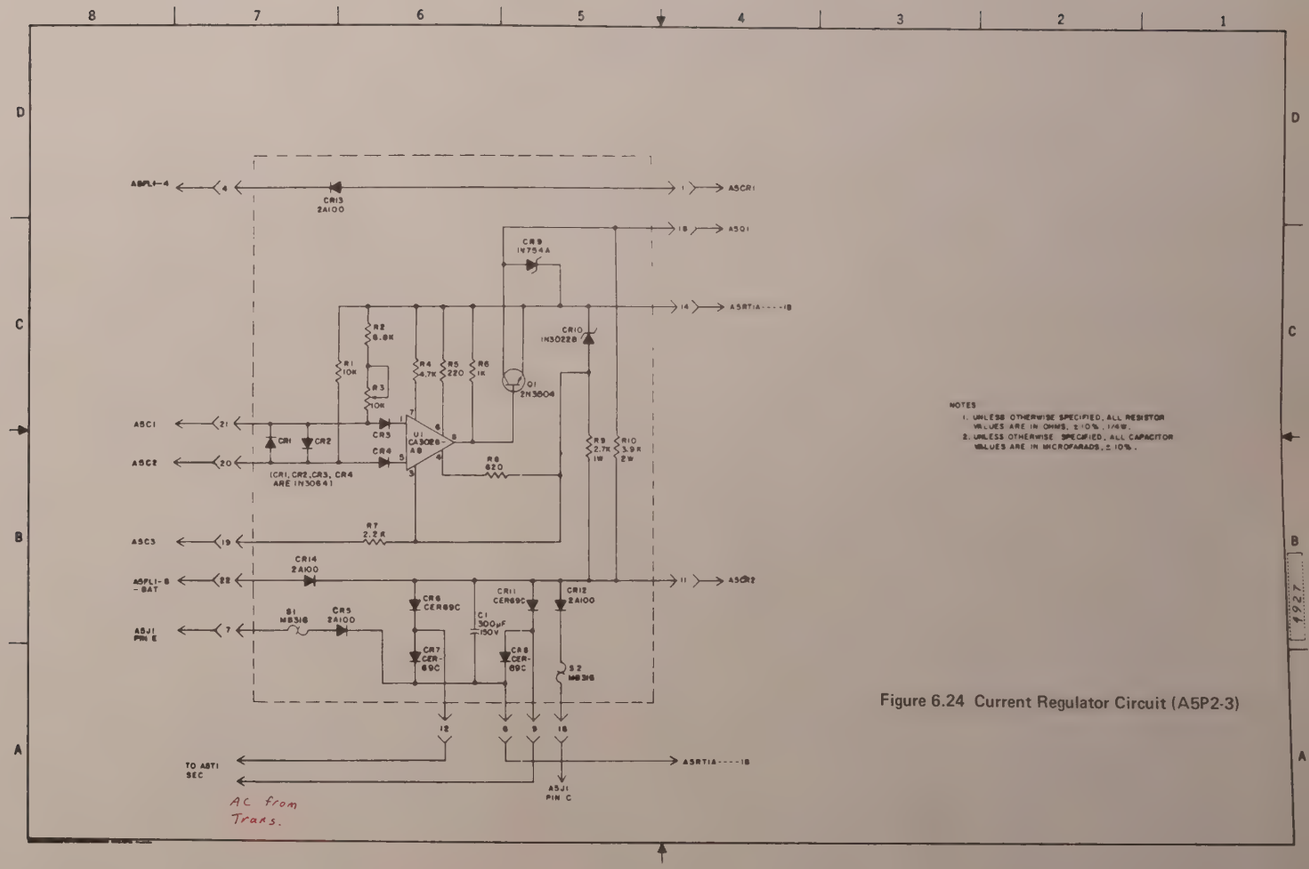


Figure 6.24 Current Regulator Circuit (A5P2-3)

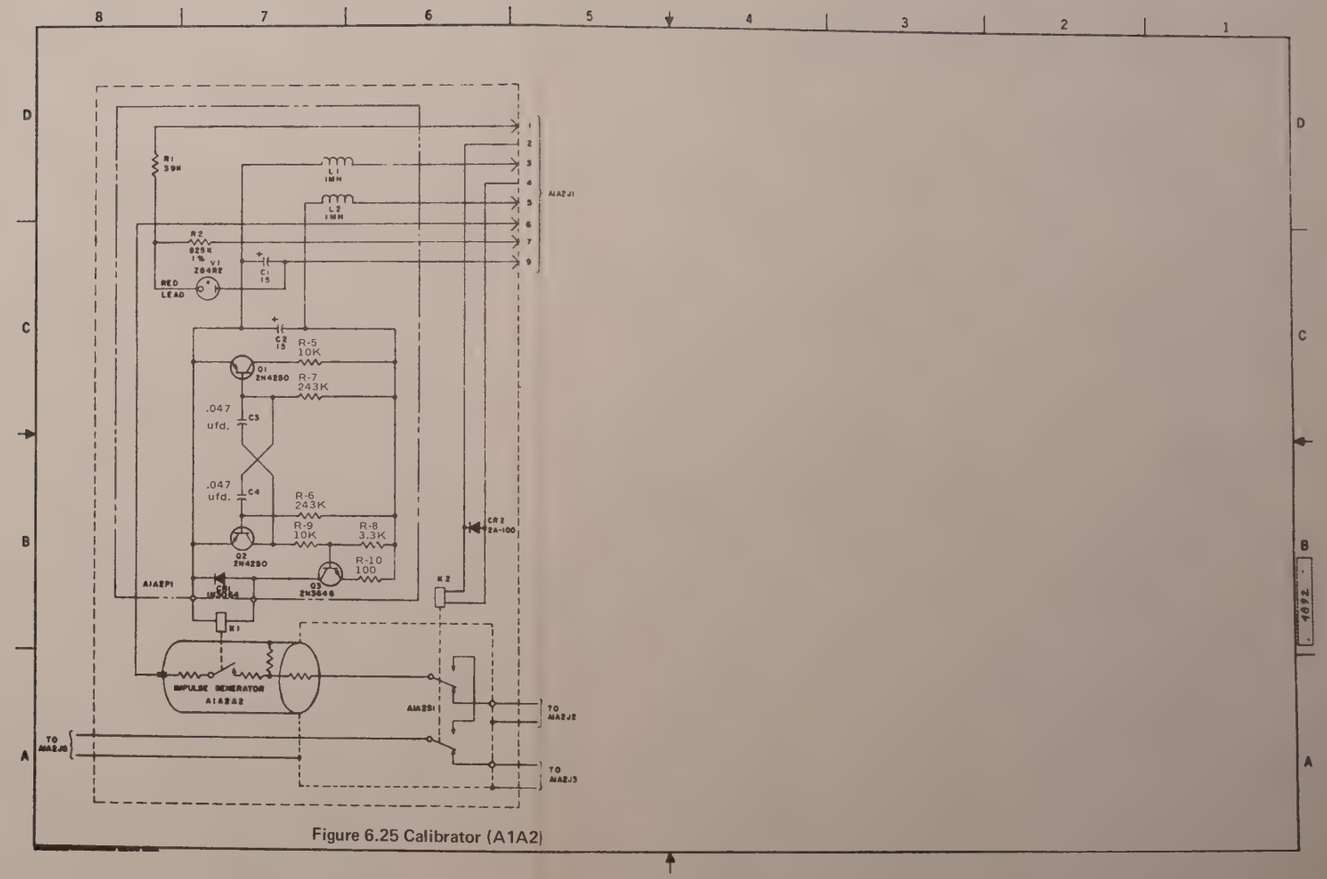


Figure 6.25 Calibrator (A1A2)

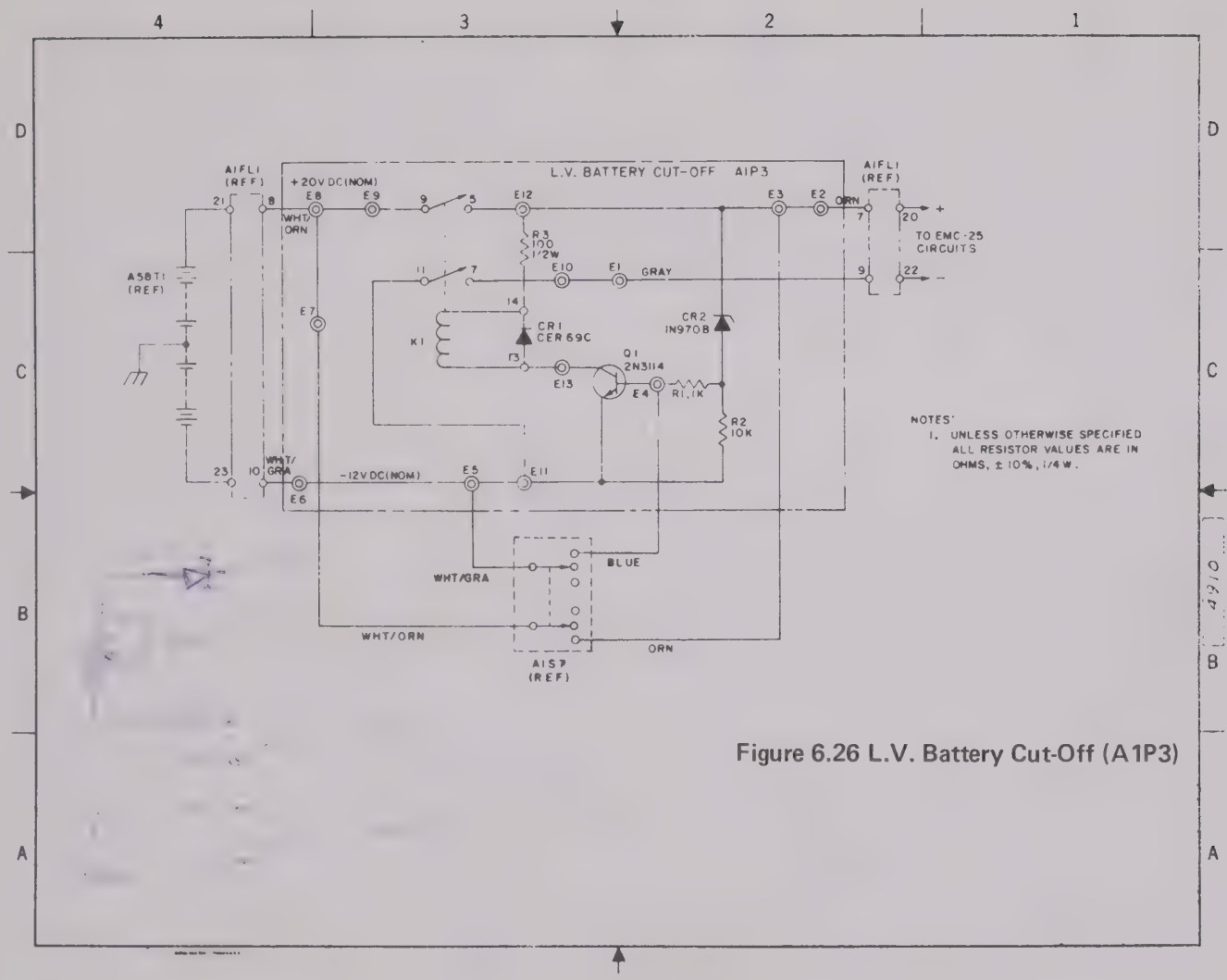
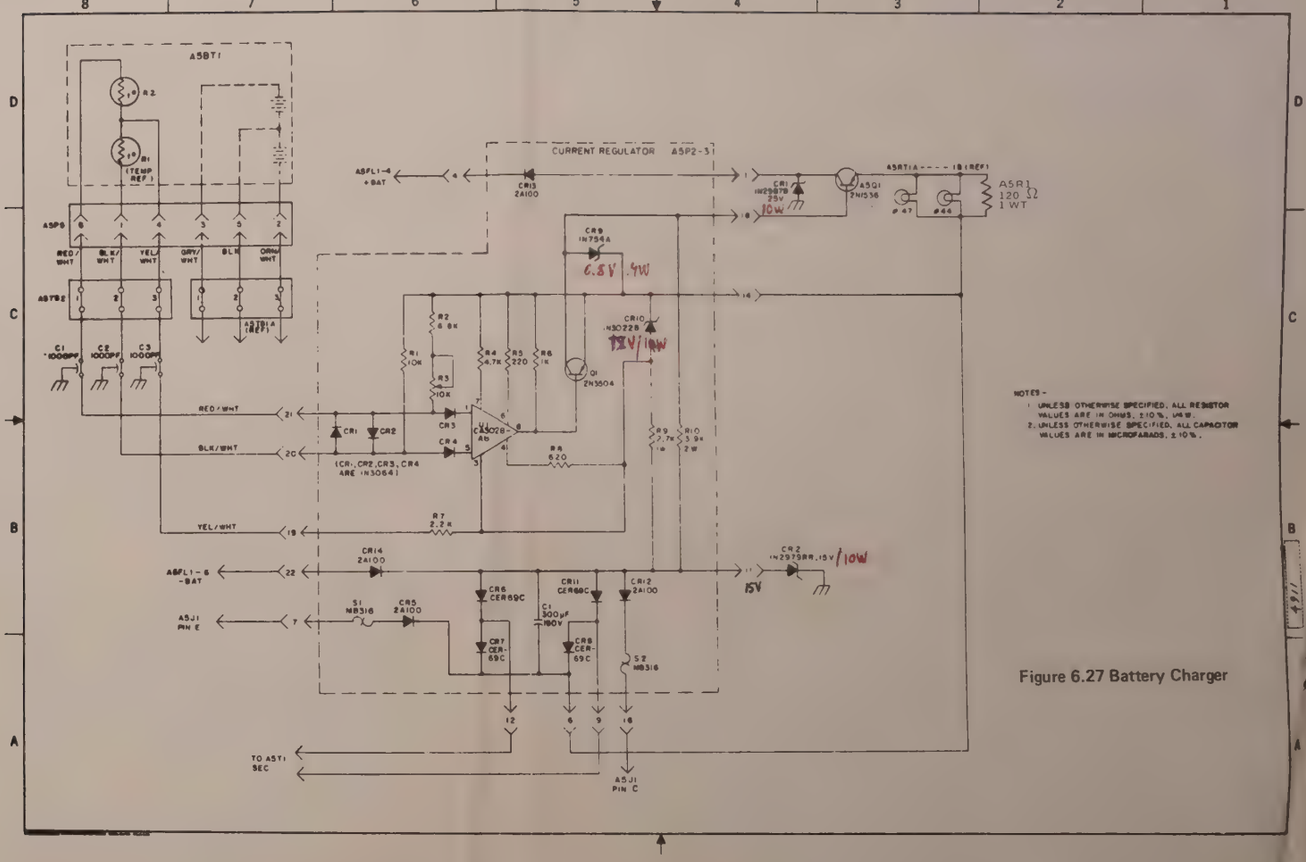
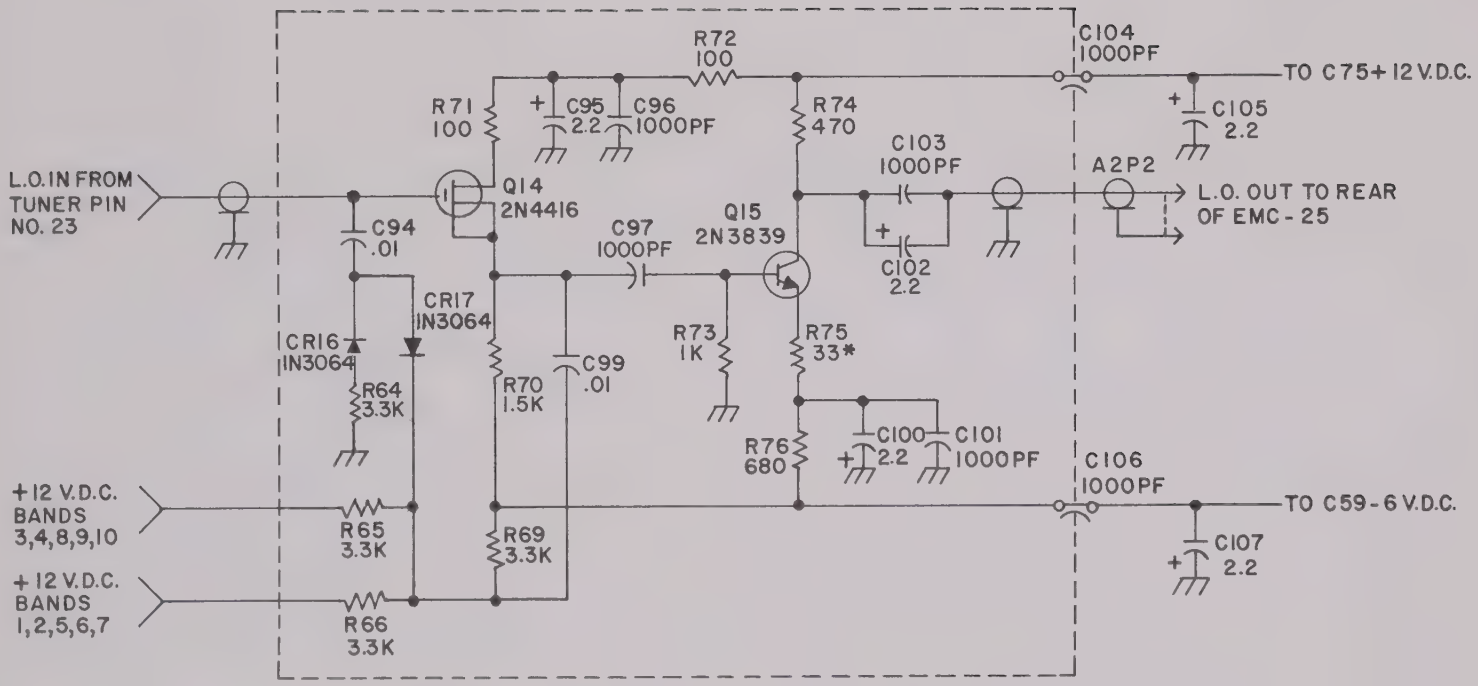


Figure 6.26 L.V. Battery Cut-Off (A1P3)



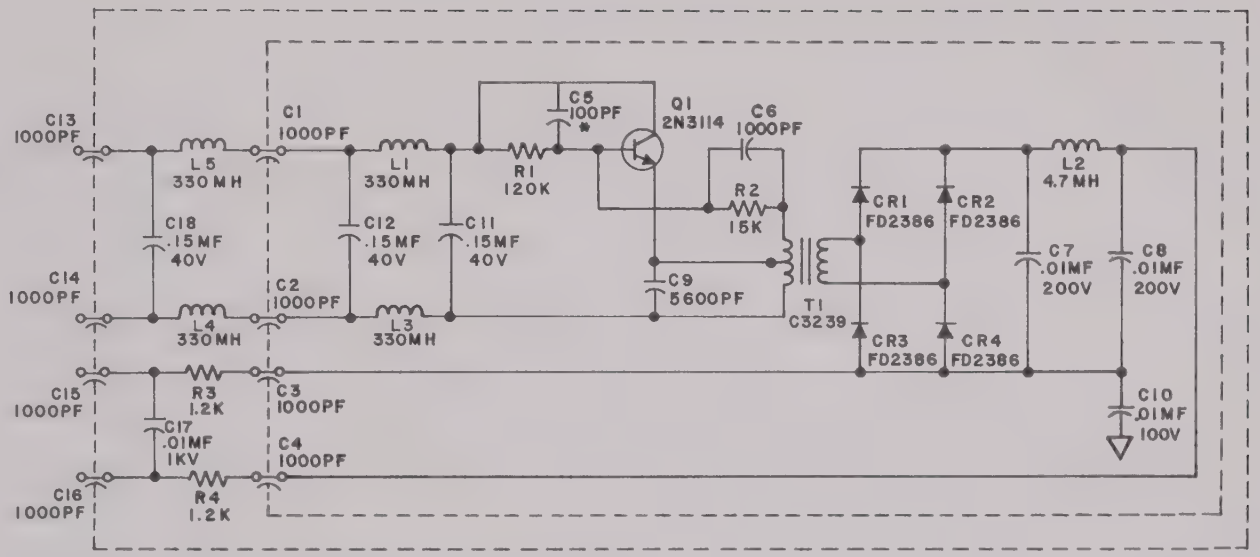
NOTES -
1. UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS, ±10%, 1/4 W
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITOR VALUES ARE IN MICROFARADS, ±10%.

Figure 6.27 Battery Charger



(A2A3)

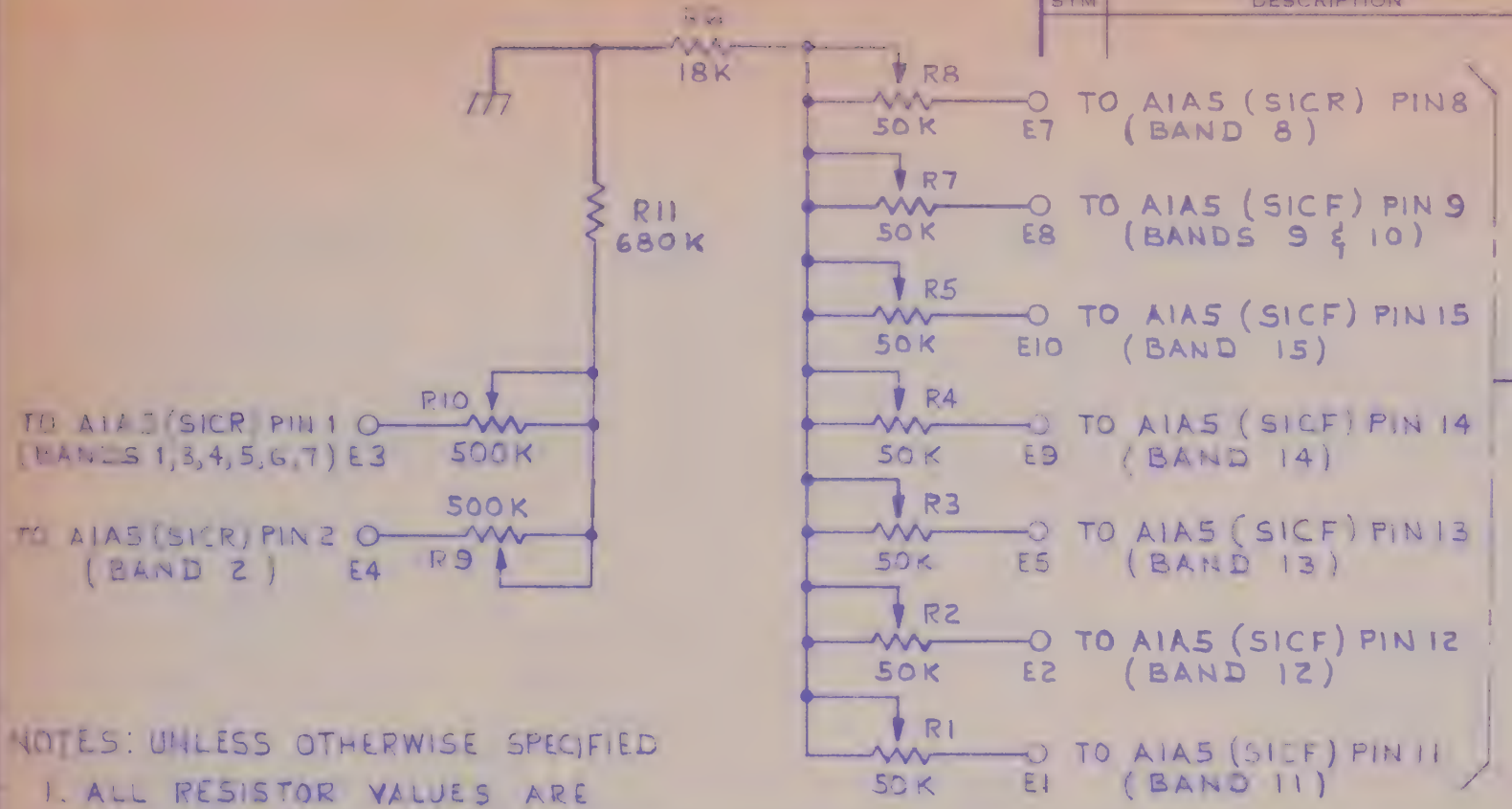
L.O. OPTION FOR
EMC-25 L
FIG. 6.28



NOTE: UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS, ±10%, 1/4 W.

FIG. 6.29. Schematic Diagram High Voltage Converter (A5A1)

REVISIONS				
SYM	DESCRIPTION	BY	DATE	APPROVAL



NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL RESISTOR VALUES ARE IN OHMS, 1/4W, ±10%.
2. COMPONENTS MARKED * ARE FACTORY ADJUSTED.

ITEM NO.	QTY.	PART NUMBER	REF. DES.	DESCRIPTION	SOURCE

MATERIAL	FINISH
—	—

TOLERANCES AND NOTES UNLESS OTHERWISE SPECIFIED

FRACTIONAL ± 1/64
DECIMAL .XXX ± .005
ANGULAR ± 0° 30'
SURFACE FINISH 125

BREAK ALL SHARP EDGES .010
ALL DIMENSIONS INCHES
DO NOT SCALE THIS DRAWING

ORIGINALLY USED ON

NEXT ASSY. B-4962 | PARTS LIST P1-4962

TITLE
SCHEMATIC DIAGRAM
I.G. LEVEL P.C. BD
(EMC-25 MK II & MK III)

ELECTRO-METRICS
AMSTERDAM NEW YORK

DRAWN	DATE 29 SEPT 76	
CHECKED	DATE	
APPROVED	DATE	
APPROVED	DATE	
REDRAWN	DATE	

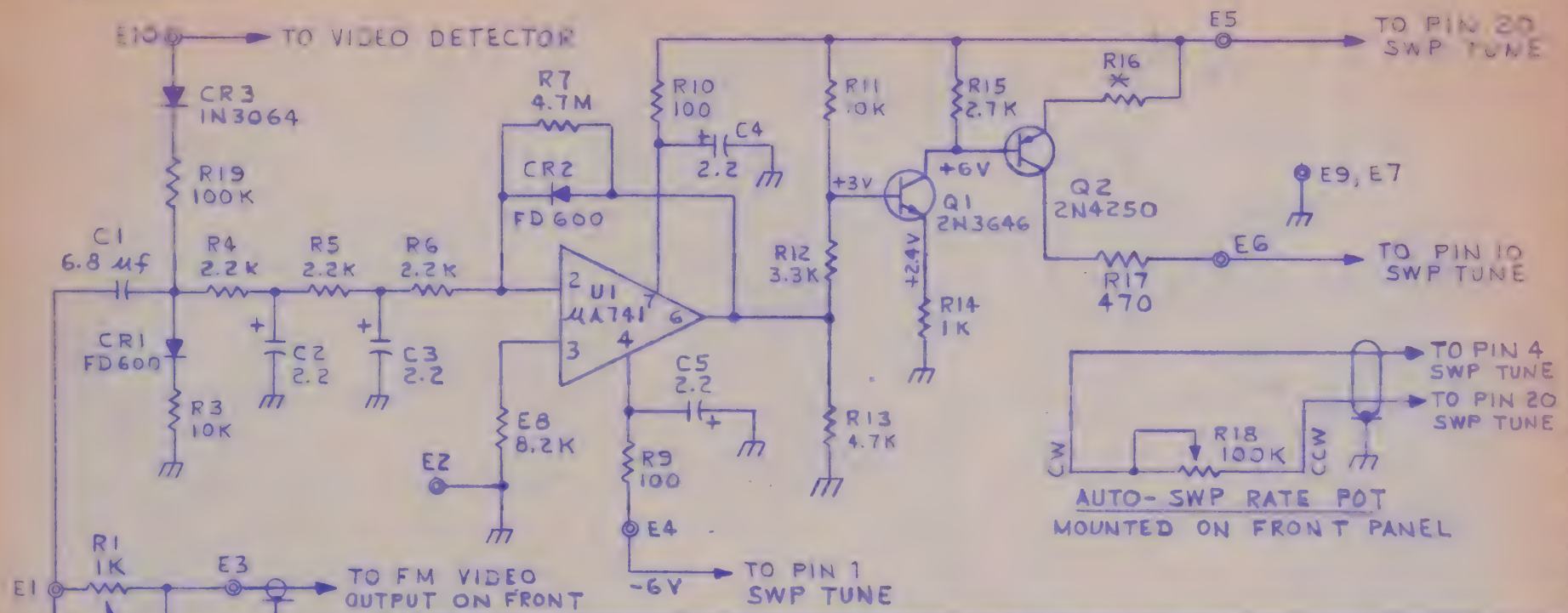
SIZE	DRAWING NUMBER	ISSUE
A	4964	

SCALE — SHEET 1 OF 1

DRAFTING MEDIA | GRAPHIC CONTROLS CORPORATION Buffalo, New York Printed in U.S.A. ULTRAVEL N490M

REVISIONS				
SYM	DESCRIPTION	BY	DATE	APPROVAL
A	REVISED, SEE LTR [illegible] IN SOLIDWORKS FILE	[illegible]	[illegible]	

1. ALL RESISTOR VALUES ARE IN OHMS, ±10%, ¼ W.
2. ALL CAPACITOR VALUES ARE IN MICROFARADS, 10%
3. COMPONENTS MARKED WITH * ARE FACTORY ADJUSTED.



ITEM NO.	QTY.	PART NUMBER	REF. DES.	DESCRIPTION	SOURCE

MATERIAL	FINISH
#	#

TOLERANCES AND NOTES UNLESS OTHERWISE SPECIFIED

FRACTIONAL ± 1/64
DECIMAL .XXX ± .005
ANGULAR ± 0° 30'
SURFACE FINISH 125

BREAK ALL SHARP EDGES .010
ALL DIMENSIONS INCHES
DO NOT SCALE THIS DRAWING

TITLE SCHEMATIC DIAGRAM
AUTO-SWEEP RATE
(EMC-25 MK II & MK III)

ELECTRO-METRICS
AMSTERDAM, NEW YORK

ORIGINALLY USED ON	
NEXT ASSY.	PARTS LIST
A-4967	

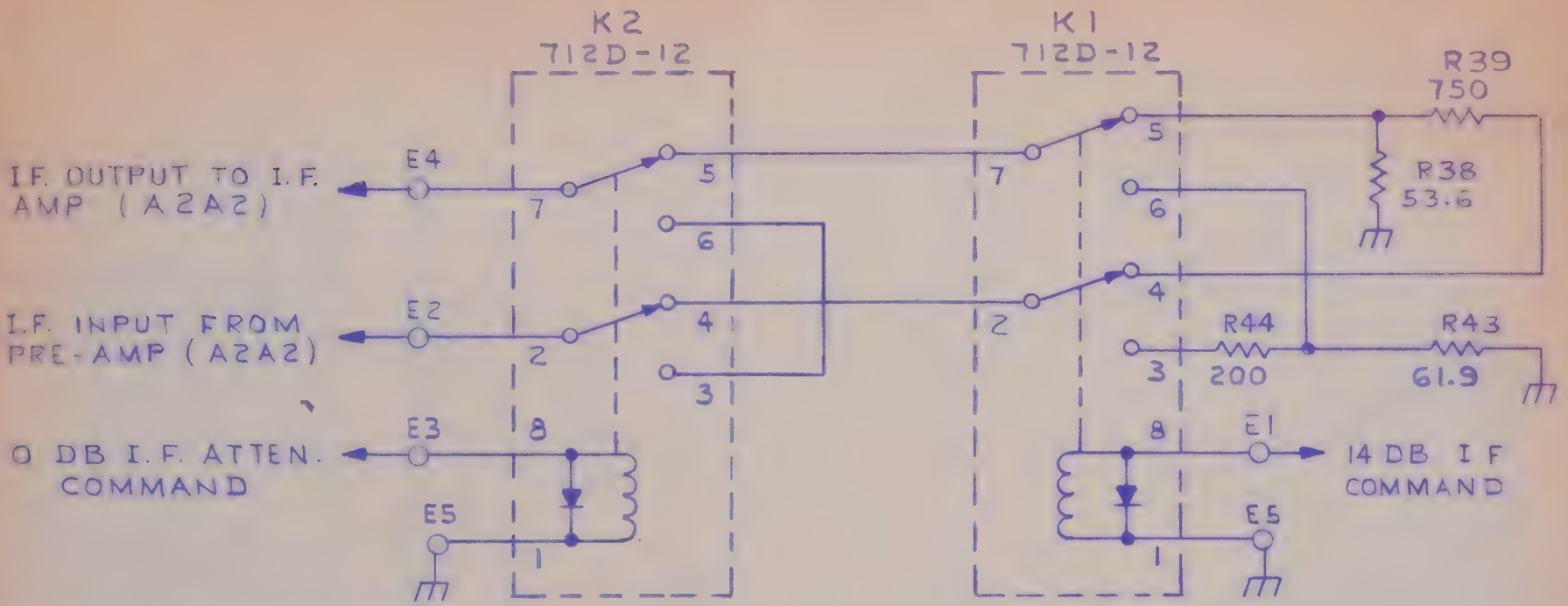
DRAWN [illegible]	DATE 29 APRIL 76	
CHECKED	DATE	
APPROVED	DATE	
APPROVED	DATE	
REDRAWN	DATE	

SIZE	DRAWING NUMBER	ISSUE
A	4369	A

SCALE: # SHEET 1 OF 1

DRAFTING MEDIA GRAPHIC CONTROLS CORPORATION Buffalo, New York Printed in U.S.A. ULTRAVEL N490M

REVISIONS				
SYM	DESCRIPTION	BY	DATE	APPROVAL



NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL RESISTOR VALUES ARE IN OHMS, 1/4 W, ±1%.
2. COMPONENTS MARKED * ARE FACTORY ADJUSTED.
3. CIRCUIT SHOWN IN 24 DB POSITION.

ITEM NO.	QTY.	PART NUMBER	REF. DES.	DESCRIPTION	SOURCE

MATERIAL	FINISH

TOLERANCES AND NOTES UNLESS OTHERWISE SPECIFIED

FRACTIONAL ± 1/64
DECIMAL .XXX ± .005
ANGULAR ± 0 30'
SURFACE FINISH 125

BREAK ALL SHARP EDGES .010
ALL DIMENSIONS INCHES
DO NOT SCALE THIS DRAWING

ORIGINALLY USED ON	
NEXT ASSY	PARTS LIST
A-4992	PL-4992

TITLE
SCHEMATIC DIAGRAM
I.F. ATTENUATOR P.C. BOARD (I.F. PRE-AMP)
EMC-25 MK II & MK III

ELECTRO-METRICS
AMSTERDAM, NEW YORK

DRAWN	[illegible]	DATE 29 SEPT 76	
CHECKED		DATE	
APPROVED		DATE	
APPROVED		DATE	
REDRAWN		DATE	

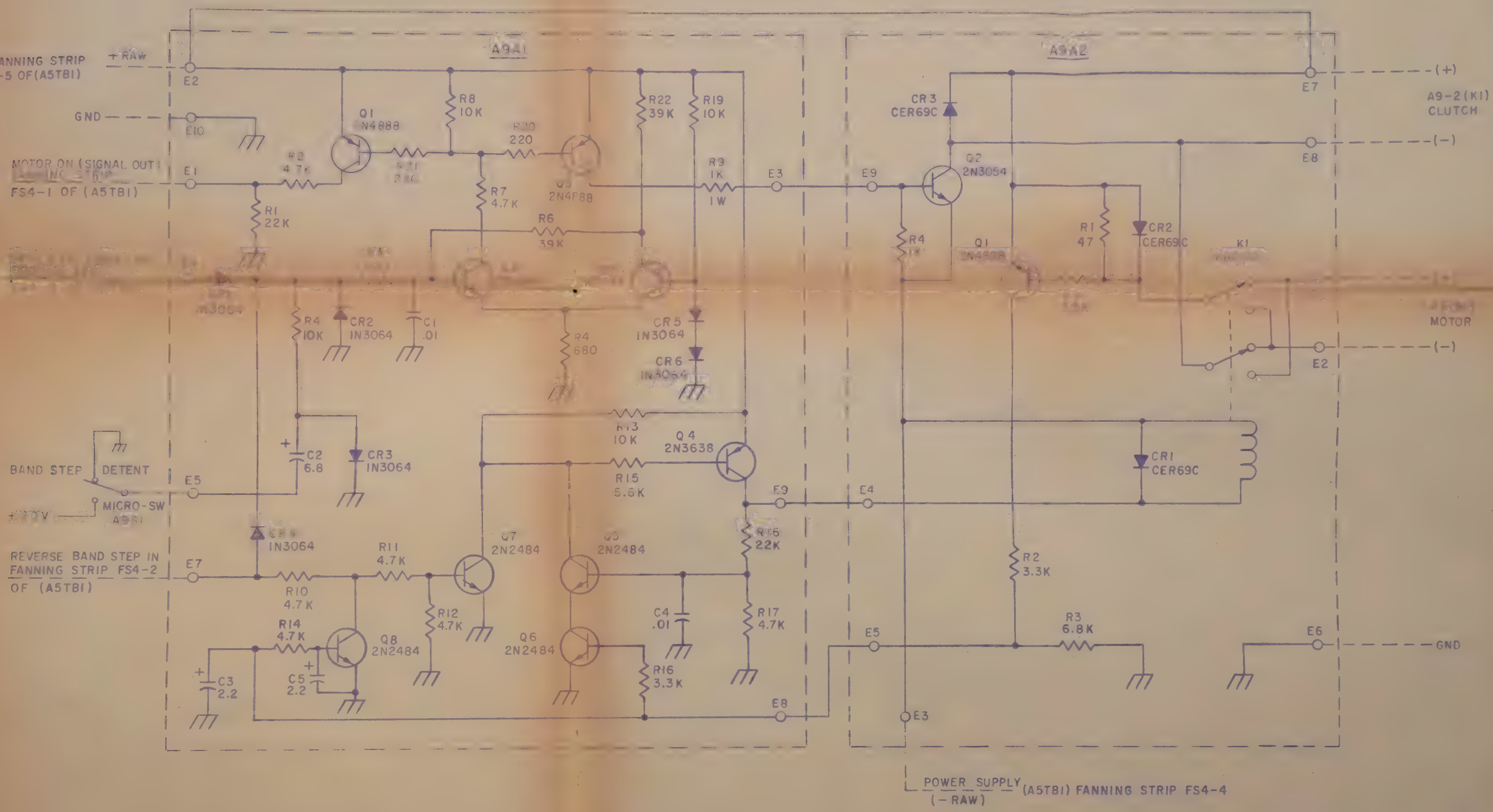
SIZE	DRAWING NUMBER	ISSUE
A	4997	

SCALE A SHEET 1 OF 1

DRAFTING MEDIA GRAPHIC CONTROLS CORPORATION Buffalo, New York Printed in U.S.A. ULTRAVEL N490M

SEE R-4867

REVISIONS				
SYM	DESCRIPTION	BY	DATE	APPROVED



NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL RESISTOR VALUES ARE IN OHMS, ±10%, 1/4 W.
2. ALL CAPACITOR VALUES ARE IN MICROFARADS ±10%.
3. COMPONENTS MARKED * ARE FACTORY ADJUSTED.

ITEM NO	QTY	PART NUMBER	REF DES	DESCRIPTION	SOURCE

MATERIAL

FINISH

TOLERANCES AND NOTES UNLESS OTHERWISE SPECIFIED

FRACTIONAL ± 1/64
DECIMAL XXX ± .005
ANGULAR ± 0 30'
SURFACE FINISH 125

BREAK ALL SHARP EDGES .010
ALL DIMENSIONS INCHES
DO NOT SCALE THIS DRAWING

ORIGINALLY USED ON

NEXT ASSY | PARTS LIST

TITLE SCHEMATIC DIAGRAM BAND MOTOR CONTROL & MOTOR DRIVE P.C. BD (EMC-25 MK III)

DRAWN FS 2A SR	DATE 27 OCT 76	
CHECKED	DATE	
APPROVED	DATE	
APPROVED	DATE	
REDRAWN	DATE	

ELECTRO-METRICS
A DIVISION OF DYNAMICS CORP. OF AMERICA
100 Church St. Amsterdam, New York 12010

SIZE	DRAWING NUMBER	ISSUE
C	4079	

SCALE 4/1 SHEET 1 OF 1

REVISIONS				
SYM	DESCRIPTION	BY	DATE	APPROVAL
A	CHANGED PER ECN 1678		6-26-68	

POWER INPUT
A5J1

EXTERNAL AC INPUT

A5F1
1-1/2 AMP

A5S1

115 AC
230 AC

A5T1

A5J2
A5P2

A5P2
A5J2

HIGH VOLTAGE CONVERTER
A5A1

C14 WHT
C13 GRN
C16 ORN
C15 RED

FILTER ASSY
A5FL1

22 (−BATTERY)
19 (− CHARGE LIGHT)
25 (+ CHARGE LIGHT)
14 (+ HIGH VOLTAGE)
29 (+ SUPPLY)
17 (+ BATTERY)
23 (− SWITCH)
24 (BATTERY COMMON)
18 (+ SWITCH)
21 (THERMOCOUPLE, 2)
20 (THERMOCOUPLE, 1)

R1 320 2W
Q1 PMD-12K-80
CR8 2A400
CR6 2A400
CR3 2A400
C2 50 50V
CR7 2A400
CR4 2A400
R3 15 3W
Q3 2N1536
R2 10 1W
CR6 IN2979 15V
C1 650C −40V
CR1 2A400
CR5 IN2987 25V
Q2 2N1536
CR16 2A400
CR11
CR8
SER690
CR14
CR7
R20 10K
Q4 2N3693
R11 100K
R23 10K
R12 15 2W
R22 3.9K
R21 10K
R4 4.7K
R5 220
R6 1K
C4 .1
CR19 IN3064
CR20 IN3064
CR18 IN3064
CR17 IN3064
U1 CA3028A
Q5 2N3504
CR9 IN754
CR10 IN3022B
R8 680 1/2W
R10 680
R7 2.2K
R16 33K
C3 .1
R13 1K
R14 1K
U2 UA741
R18 1K
Q6 2N3440
R19 2.7K

POWER SUPPLY CIRCUIT BOARD
A5P1

NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTOR VALUES ARE IN OHMS, ± 10%, 1/4 W.
2. ALL CAPACITOR VALUES ARE IN MICROFARADS, ± 10%.
3. COMPONENTS MARKED * ARE FACTORY ADJUSTED.

F.C.6.18 6-26

ITEM NO	QTY	PART NUMBER	REF. DES.	DESCRIPTION	SOURCE
MATERIAL				FINISH	

TOLERANCES AND NOTES UNLESS OTHERWISE SPECIFIED
FRACTIONAL ± 1/64
DECIMAL XXX ± .005
ANGULAR ± 0 30'
SURFACE FINISH 125
BREAK ALL SHARP EDGES .010
ALL DIMENSIONS INCHES
DO NOT SCALE THIS DRAWING

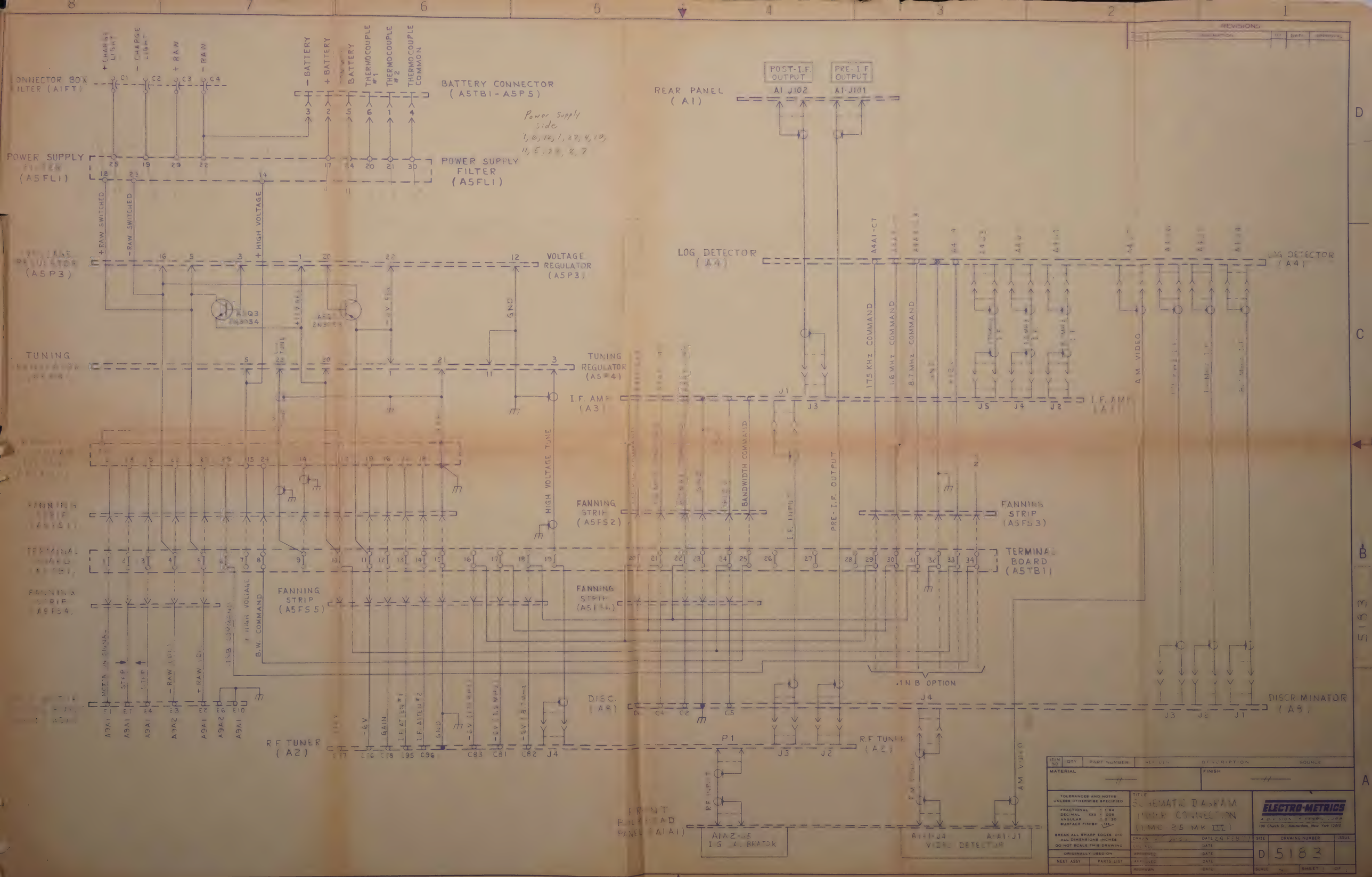
ORIGINALLY USED ON
NEXT ASSY C-4984 | PARTS LIST FL-

TITLE
SCHEMATIC DIAGRAM
POWER SUPPLY
EMC-25 MK II, (A5)

ELECTRO-METRICS
A DIVISION OF DYNAMICS CORP
100 Church St., Amsterdam, New York 12010

DRAWN	DATE 3-20-68	SIZE	DRAWING NUMBER / ISSUE
CHECKED	DATE	D	4080 A
APPROVED	DATE		
APPROVED	DATE	SCALE	SHEET OF
REDRAWN	DATE		

4080 B


REVISIONS
DESCRIPTION
BY
DATE
APPROVED
CONNECTOR BOX FILTER (A1FT)
+ CHARGE LIGHT
- CHARGE LIGHT
+ RAW
- RAW
C1
C2
C3
C4
BATTERY CONNECTOR (A5TB1-A5P5)
- BATTERY
+ BATTERY
BATTERY
THERMOCOUPLE #1
THERMOCOUPLE #2
THERMOCOUPLE COMMON
Power Supply side
1, 10, 12, 1, 27, 4, 10,
11, 5, 28, 8, 7
POWER SUPPLY
POWER SUPPLY FILTER (A5FL1)
+ RAW SWITCHED
- RAW SWITCHED
+ HIGH VOLTAGE
VOLTAGE REGULATOR (A5P3)
TUNING REGULATOR (A5P4)
GND
TUNE
HIGH VOLTAGE TUNE
REAR PANEL (A1)
POST-I.F. OUTPUT
A1 J102
PRE-I.F. OUTPUT
A1-J101
LOG DETECTOR (A4)
A4A1-C7
175 KHz COMMAND
1.6 MHz COMMAND
8.7 MHz COMMAND
AM VIDEO
I.F. AMP (A3)
J1
J3
J5
J4
J2
FANNING STRIP (A5FS1)
FANNING STRIP (A5FS2)
FANNING STRIP (A5FS3)
FANNING STRIP (A5FS4)
FANNING STRIP (A5FS5)
TERMINAL BOARD (A5TB1)
BANDWIDTH COMMAND
I.F. INPUT
PRE-I.F. OUTPUT
HIGH VOLTAGE COMMAND
B.W. COMMAND
.1 N B OPTION
DISC. (A8)
DISCRIMINATOR (A8)
RF TUNER (A2)
-6V
GAIN
I.F. ATTEN #1
I.F. ATTEN #2
GND
-6V (1.2 MHz)
-6V (8.7 MHz)
C96
C83
C81
C82
J4
P1
J3
J2
RF INPUT
AM VIDEO
FRONT BULKHEAD PANEL (A1A1)
A1A2-J5 I.G.A. BRACKET
A1A1-J4 A1A1-J1 VIDEO DETECTOR
ITEM NO
QTY
PART NUMBER
REF DES
DESCRIPTION
SOURCE
MATERIAL
FINISH
TOLERANCES AND NOTES UNLESS OTHERWISE SPECIFIED
FRACTIONAL ± 1/64
DECIMAL .XXX ± .005
ANGULAR ± 0° 30'
SURFACE FINISH 125
BREAK ALL SHARP EDGES .010
ALL DIMENSIONS INCHES
DO NOT SCALE THIS DRAWING
ORIGINALLY USED ON
NEXT ASSY
PARTS LIST
TITLE
SCHEMATIC DIAGRAM
MINOR CONNECTION
(1 MC 25 MK III)
ELECTRO-METRICS
A DIVISION OF FENDALCO INC
100 Church St. Amsterdam, New York 12010
DRAWN
DATE 24 FEB 67
CHK'D
DATE
APPROVED
DATE
APPROVED
DATE
REDRAWN
DATE
SIZE
DRAWING NUMBER
ISSUE
D
5183
SCALE
SHEET
OF

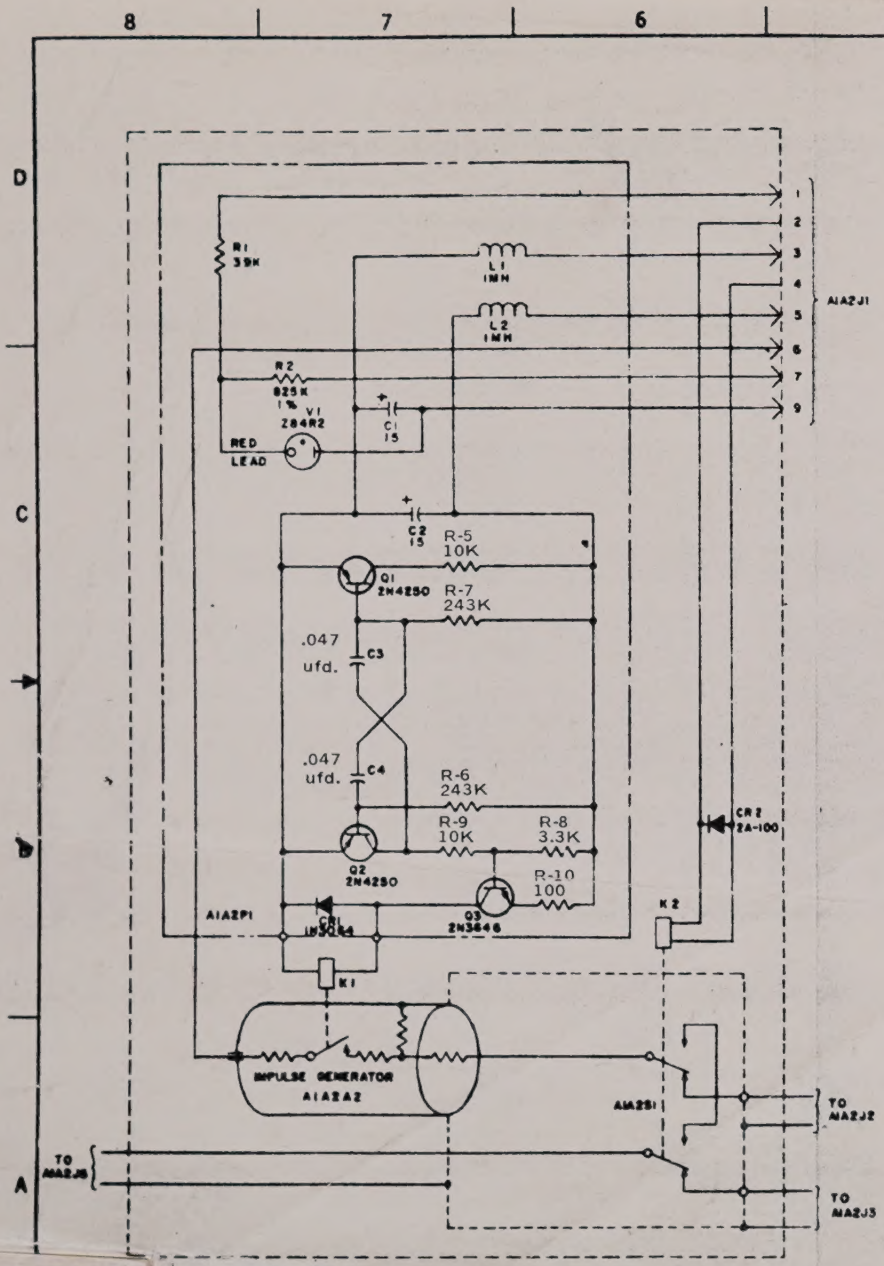


Figure 6.25 Calibrator (A1A2)

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